

Trouble-shooting instructions : BMW-5009  
BOSCH system : ABS-ASR  
Vehicle make : BMW  
Basic microcard : PKW-081

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SPECIAL FEATURES

This microcard contains the trouble-shooting instructions for the following models valid at the time of printing:

\* BMW 735i, 8.87->

Electronic traction control (ASR) combined with ABS2.

One common controller with 55-pin plug for ABS and ASR

ASR control acts on Motronic and electronic accelerator

A special adapter lead is required for testing. The adapter lead has 2 round-pin plugs: one for connection to the ABS 2 LED tester for ABS testing and a second plug for connection to the universal test adapter for testing the ASR.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

For a detailed description of trouble-shooting, see the basic instructions.

ATTENTION :  
The set values, terminal assignments and special features of these vehicle-specific brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

\*For safety reasons, the hydraulic modulator must not be repaired, but may be replaced only as a complete unit.

Exception: relays.

\*Do not loosen any screws on the hydraulic modulator!

Danger due to brake failure.

\*Caution when handling brake fluid.

Poisonous!

\*Before testing on the chassis dynamometer and on the brake test stand, disconnect ABS/ASR controller plug.

\*Tow away with front axle raised only with ignition off.

See basic instructions for further information.

### How to activate the self-diagnosis.

+Ignition off.

+Press ASR switch and brake pedal simultaneously.

+Keep pressed and switch on ignition.

+Continue to keep pressed for at least 1 second after switching on the ignition. Then release ASR switch and brake pedal.

+Approx. 3 seconds after ignition has been switched on, ASR indicator lamp starts to flash.

For production reasons:  
continued on the following  
coordinate.

# SELF-DIAGNOSIS TEST TABLE

for BMW ASR (flashing code applies only to controllers with blue nameplate. Controllers with yellow nameplate do not contain a flashing code. Start test with test adapter).

Fault indication Flashing code	Component/function under test	Test instructions/Test conditions	Terminals	Set values
1	No fault stored			—
2	Electronic-accelerator control unit. Functions: throttle-valve input, reduction, increase. Lead to term. 47. Motronic control unit, functions: overrun cut-off, ignition-timing advance.	Test with universal test adapter.	43, 46 47, 48	—
3	Motronic control unit. Function: ignition cut-out	Test with universal test adapter.	45	—
4	Speed sensor rear left	Perform signal with test ABS LED tester.	30, 29	0,6...1,6 k $\Omega$
5	Speed sensor rear right	Perform signal with test ABS LED tester.	10, 28	0,6...1,6 k $\Omega$
6	Speed sensor front right	Perform signal with test ABS LED tester.	13, 12	0,6...1,6 k $\Omega$
7	Speed sensor front left	Perform signal with test ABS LED tester.	8, 26	0,6...1,6 k $\Omega$
8	Lead to term.45	Test with universal test adapter.	45	—
9	Motronic control unit. Function: ignition signal term. 1	Test with universal test adapter.	38	—
10	ABS/ASR controller	Exchange ABS/ASR controller.	—	—

## RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: 1 684 463 200

Test step	Switch V	$\Omega$	Termi- nals	Component/function under test	Test instructions/ Test conditions	Set values
1	 V	1	41-18	Shielding of ignition cable	Ignition off.	less than 10 ohm
2.1	4	1	1-18	Power supply to controller	Ignition off.	0 volt
2.2					Ignition on.	10.3...15 volt
3.1	3	1	52-18	Signal from handbrake	Ignition on. Release handbrake.	greater than 7 volt
3.2					Ignition on. Pull on handbrake.	less than 0.5 volt
4.1	7	1	38-18	Lead to Motronic control unit term. 1	Ignition on.	10.3...15 volt
4.2					Ignition off.	less than 0.5 volt
5.1	8	1	48-18	Lead to electronic- accelerator control unit. Throttle-valve increase.	Ignition off.	less than 0.5 volt
5.2					Ignition on.	greater than 7.5 volt
6.1	9	1	46-18	Lead to electronic- accelerator control unit. Throttle-valve reduction.	Ignition on.	greater than 7.5 volt
6.2					Ignition off.	Less than 0.5 volt
7.1	10	1	43-18	Lead to electronic- accelerator control unit. Throttle-valve input (actual value)	Ignition off.	Less than 0.5 volt
7.2					Ignition on. Press accelerator:	Voltage rise
8.1	11	1	54-18	ASR switch	Ignition on.	Less than 0.5 volt
8.2					Ignition on. Press ASR switch:	10.3...15 volt
9.1	11	1	51-18	ASR indicator lamp	Ignition on.	ASR lamp off
9.2					Ignition on. Press button 2:	ASR lamp lit
10	11	1	34-18	Check control: "ASC defective"	Operate engine at idle speed. Perform visual examination of indication in vehicle. Press button 1:	Indication "ASC defective" changes once with indication "operating instructions"; gong sounds.



# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: ASC-BMW

Test step	Switch		Terminals	Component/function under test	Test instructions/ Test conditions	Set values
	V	Ω				
11	11	1	53-18	Check control: "ASC" (means ASR in operation)	Operate engine at idle speed. Perform visual examination of indication in vehicle. Press button 3:	Indication "ASC" symbols flash.
12	11	1	45-1	Ignition cutout by Motronic	Operate engine at 2000 min <sup>-1</sup> ; keep position of accelerator constant. Press button 5 for max. 1 second. Engine speed drops to set value and rises again after button 5 is released. Note: if button 5 is pressed for longer than 1 second, it is not possible to repeat the test until after the ignition has been switched off and on.	1000...1400 min <sup>-1</sup>
13	11	1	47-1	Timing-advance adjustment by Motronic	Operate engine at 2500 min <sup>-1</sup> ; keep position of accelerator constant. Press button 6 for approx. 1 second. Engine speed drops to set value and rises again after button 6 is released.	1600...2000 min <sup>-1</sup>
14	12	1	42-18	Power supply (continuous positive at battery)	Ignition off.	10.3....15 volt

## Final test

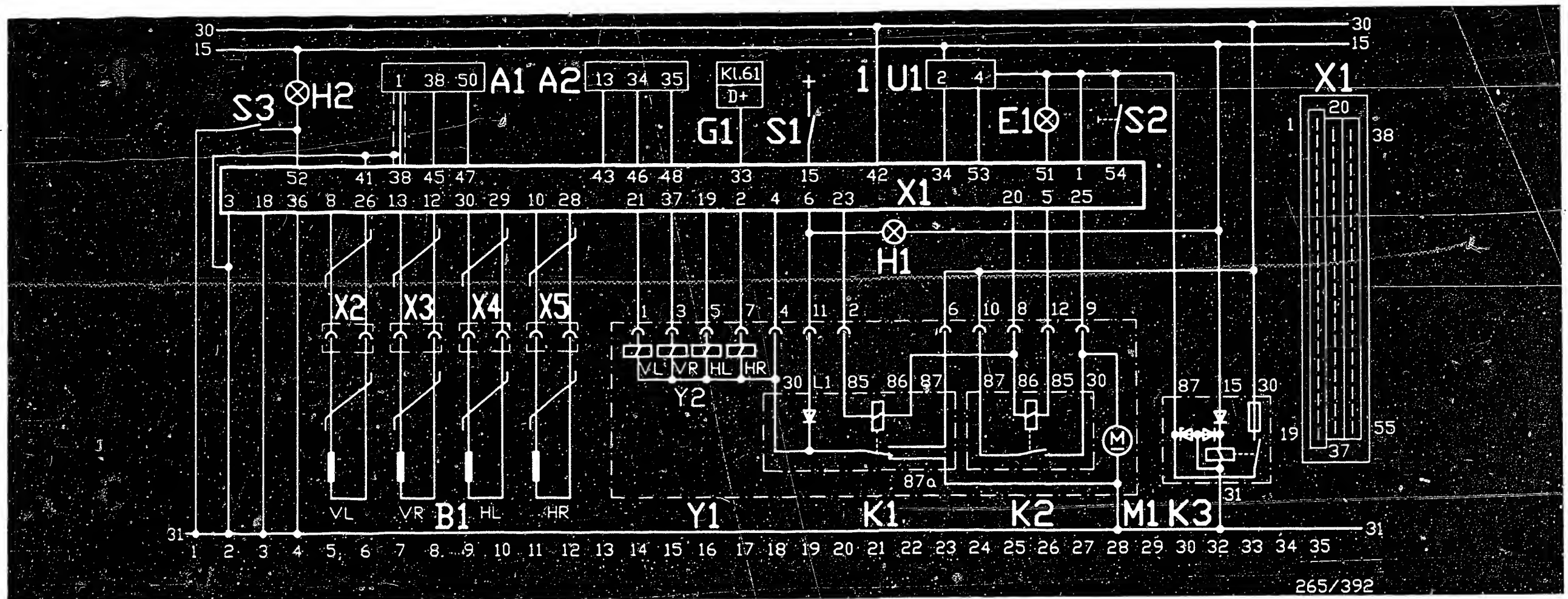
Connect all control units.

Switch on ignition: ASR repeater lamp must light up. No indication by check control.

Start engine and run at high speed:  
ASR repeater lamp continues to light up.  
No indication by check control.

Take for a test drive:  
Drive for at least 20 seconds at a speed exceeding 30 km/h and for 3 seconds at at least 50 km/h.  
ASR repeater lamp must continue to light up.  
No indication by check control.

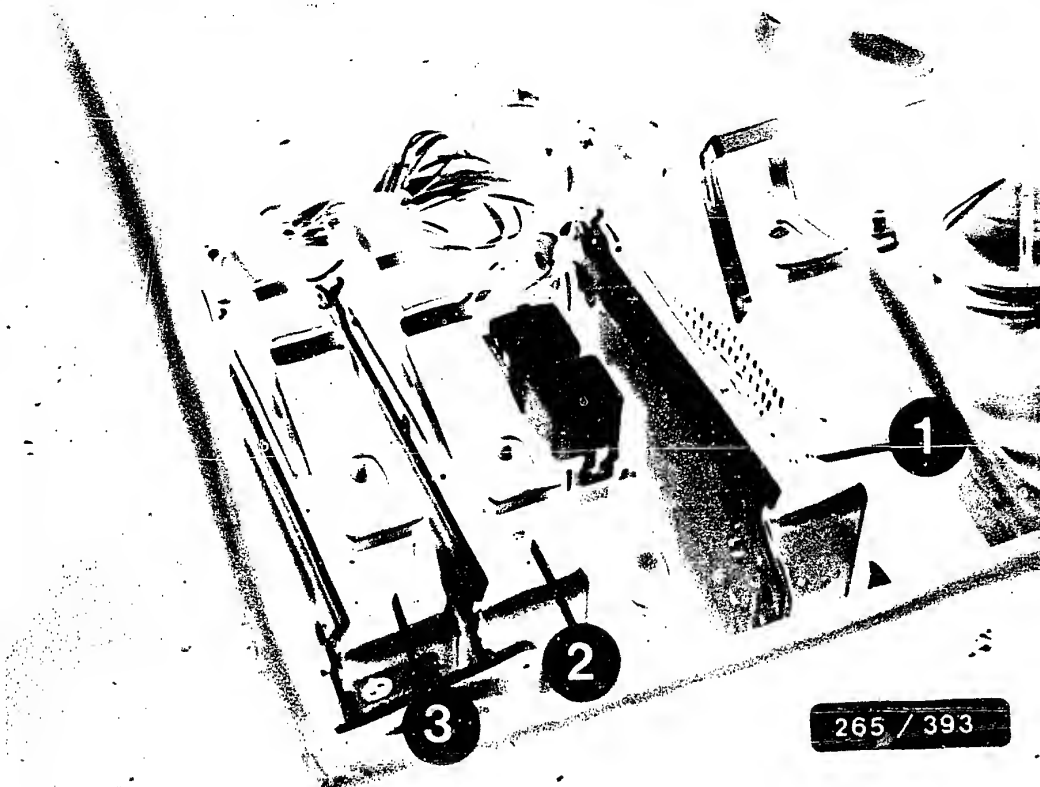
For production reasons:  
continued on the following  
coordinate.



A1 = Motronic control unit  
 A2 = Electronic-accelerator control unit  
 B1 = Speed sensor  
 E1 = ASR indicator lamp  
 G1 = To alternator term. 61/D+  
 H1 = ABS warning lamp  
 H2 = Handbrake indicator lamp  
 K1 = Valve relay  
 K2 = Motor relay  
 K3 = Overvoltage-protection relay  
 M1 = Pump motor

S1 = Stop-lamp switch  
 S2 = ASR switch  
 S3 = Handbrake switch  
 U1 = Check control (blue plug)  
 X1 = ABS/ASR controller plug  
 X2, X3, X4, X5 = Speed-sensor plug  
 Y1 = Hydraulic modulator  
 Y2 = Solenoid-operated valves  
 HL, HR = rear left/right  
 VL, VR = front left/right  
 1 = for controller with blue nameplate

ELECTRICAL TERMINAL DIAGRAM BMW 735i, 8.87->



- 1 = ABS/ASR controller
- 2 = E Gas (elec. accel.-pedal control unit
- 3 = Motronic control unit

#### INSTALLATION POSITION OF COMPONENTS

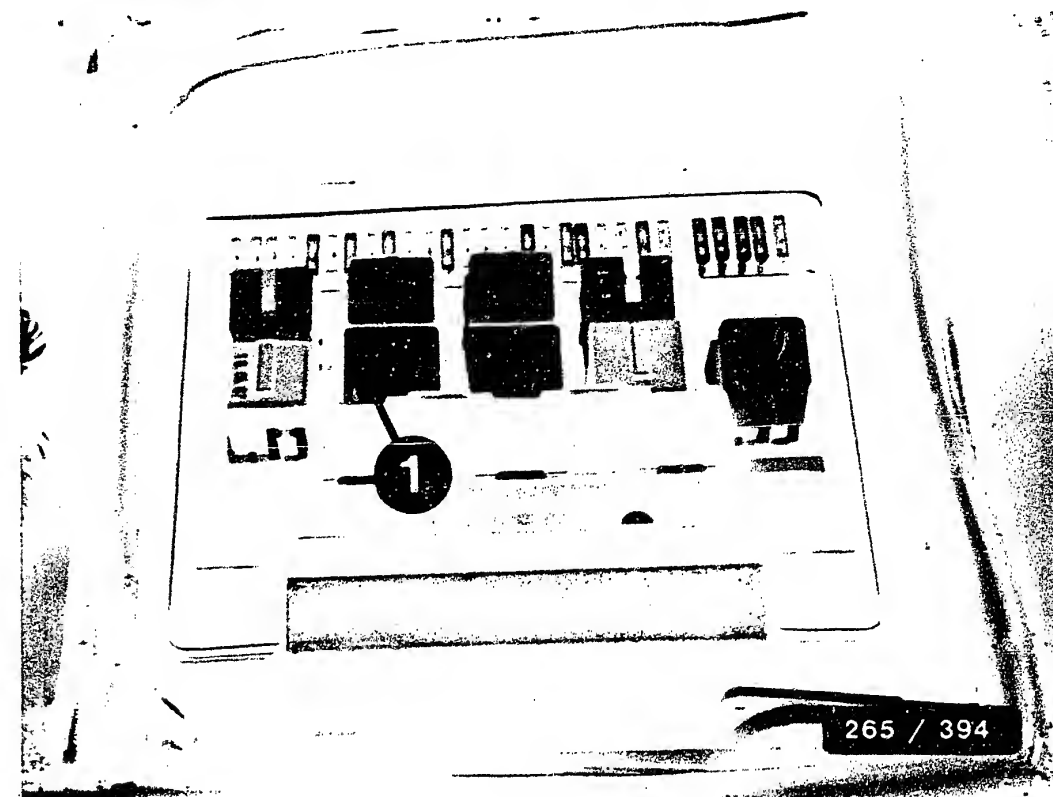
##### ABS/ASR controller (Item 1):

In the engine compartment beneath the hood.

Unscrew cover.

Remove plug:

Fold up unlatching clip and unhook plug on the wiring-harness side from the mechanical encoding unit.

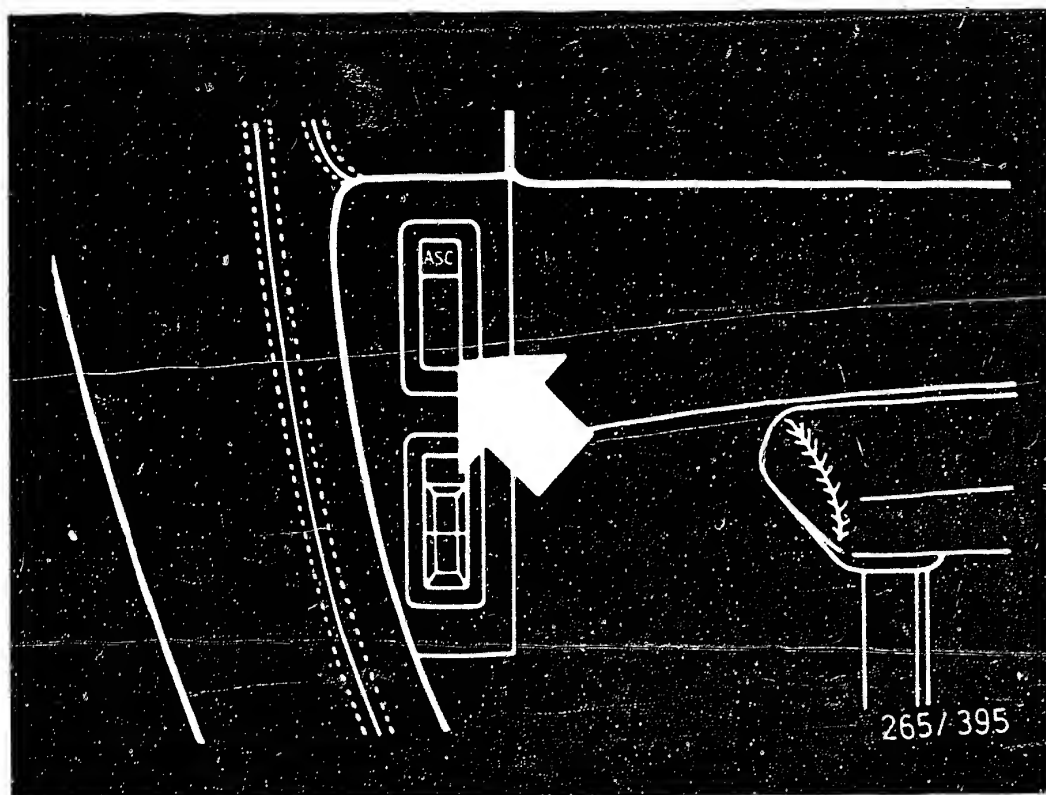


- 1 = Overvoltage-protection relay

#### INSTALLATION POSITION OF COMPONENTS (Continued)

##### Overvoltage-protection relay:

In the fuse and relay box. Relay box in the engine compartment on the left-hand side in front of the firewall.



Arrow = ASR repeater lamp and ASR nonlocking switch

#### INSTALLATION POSITION OF COMPONENTS (Continued)

ASR repeater lamp and ASR nonlocking switch:  
In the passenger compartment in the center console.

ASR warning indication and ASR information  
via check control in instrument panel.

Ground terminal:  
In the engine compartment at the control-unit  
box on the left-hand side beneath a cover.

For production reasons:  
continued on the following  
coordinate.

Trouble-shooting instructions : BMW-5010  
BOSCH system : Motronic M1.1  
Make of vehicle : BMW  
Basic microcard : PKW-052

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## SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

- \*BMW 535i with 3.5 l / 6 cyl. as of 12.86  
BMW M 535i with 3.5 l / 6 cyl. as of 1.87  
BMW 635 CSi with 3.5 l / 6 cyl. as of 1.87
- \*Motronic system M 1.1 with self-diagnosis and flashing-code output (55-pin plug).
- \*Control unit with variant coding, see information in the basic instructions.
- \*Control unit with integral holding circuit (for tank-ventilation valve).
- \*One common sensor for engine speed and reference mark.
- \*Group injection: divided into 2 groups which inject with staggered timing.  
Group 1: cylinders 1, 3, 5.  
Group 2: cylinders 2, 4, 6.  
Detection via sensor on H.T. lead to cylinder 6.
- \*Adaptive lambda closed-loop control (if vehicle fitted with catalytic converter).
- \*Tank ventilation with pulsed valve (if vehicle fitted with catalytic converter).
- \*Pay particular attention when trouble-shooting to the following:  
if desired, these vehicles can be equipped with an on-board computer which has an anti-theft warning function. If the code for unpriming the system has been incorrectly entered or there is a defect in the on-board computer, terminal 38 of the Motronic control unit is connected to positive and the engine cannot be started. For rapid diagnosis, disconnect the on-board computer and warning-system module; the voltage at term. 38 must be 0 V.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!  
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

\* Avoid injection of fuel and high-voltage flashovers when testing the compression.  
Therefore, disconnect main relay.

TROUBLE-SHOOTING CHART

Customer complaints (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/ top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

											Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*											Voltage at control unit
*											Engine-speed/reference mark sensor
*		*			*	*					Fuel pressure
*		*			*	*					Solenoid-operated injection valves
		*	*		*						Throttle-valve switch
		*	*	*	*	*	*				Air-flow sensor
		*	*	*							Idle actuator
*	*	*	*								Air-intake system
		*									Idle speed, CO
*		*		*	*						Ignition coil
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*		*	*		Ignition point
*			*								High-voltage sensor
		*									Overrun cut-off
		*	*	*							Interference-suppression resistors
		*	*	*							Noise test
					*						Interference
					*						Throttle valve
					*						Fuel delivery
	*	*	*				*				Tank vent
		*	*								Lambda closed-loop control
*	*	*	*	*	*	*	*	*	*	*	Control unit

## SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/ Test conditions	Terminals	Set values
1 2 1 1	Control unit (memory contents)	Control unit defective.		—
1 2 1 5	Air-flow sensor	Check lead to term. 7 for open circuit, short circuit to ground or to positive (5V or batt. +ve) and for contact with term. 12 and term. 26. Check leads to term. 12 and term. 26 for open circuit. Check resistors of air-flow sensor: between term.26 and term.7 (def. air-fl. sens. flap): between term. 26 and term. 12:	7,12,26	—  8...2500 Ω 500...1100 Ω
1 2 2 1	Lambda sensor	Lead to lambda sensor open-circuited, short-circuited to ground or battery voltage. Watch for damage to cable insulation. Sensor heater defective. Sensor clogged.	28	—
1 2 2 2	Lambda closed-loop control to rich or lean stop	Check CO content! Check induction system for leaks. Check fuel pressure! Injection valves defective.		0,4...1,2 % by vol.
1 2 2 3	Coolant-temperature sensor	Check temperature sensor and lead for open circuit and short circuit to ground.  Temperature-sensor resistance:      at +15...+30°C ; at approx. +80°C ;	45	—  1450...3300 Ω 280...360 Ω



## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions / Test conditions	Terminals	Set values
1 2 2 4	Air-intake temperature sensor	Check temperature sensor and lead for open circuit and short circuit to ground.  Temperature-sensor resistance at +15° C... +30°C:	44	——  1450...3300 Ω
1 2 3 1	Supply voltage for control unit with engine running	Supply voltage too low: Check voltage drops at positive and ground terminals. Charge battery.  Supply voltage too high : Check alternator regulator.	37(+), 19(-)	Greater than 10 V  Less than 16 V
1 2 3 2	Throttle-valve switch/ idle contact	Fault: idle contact constantly closed.  Idle contact closed in inoperated position: Slightly actuate throttle valve :	52	0 Ω Infinity Ω
1 2 3 3	Throttle-valve switch/ full-load contact	Fault: full-load contact constantly closed.  Full-load contact closed in full-throttle position: Ease off accelerator pedal slightly.	53	0 Ω Infinity Ω
1 2 5 1	Injection valves 1+3+5 and control unit (injection output stage)	Fault: short circuit to ground, to batt. +ve or open circuit in common positive or negative lead. Check lead and valves 1+3+5 for short circuit and open circuit; if O.K., control unit defective.	16	4,8...5,7 Ω (3 valves in parallel) 14,5...17 Ω (1 injection valve)

## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions / Test conditions	Terminals	Set values
1 2 5 2	Injection valves 2+4+6 and control unit (injection output stage)	Fault: short circuit to ground, to batt. +ve or open circuit in common positive or negative lead. Check lead and valves 2+4+6 for short circuit and open circuit; if O.K., control unit defective.	17	4,8...5,7 $\Omega$ (3 valves in parallel) 14,5...17 $\Omega$ (1 injection valve)
1 2 6 2	Idle actuator and control unit (output stage)	Fault: short circuit to ground or to batt. +ve. Check leads for contact with ground or batt. +ve; if O.K., control unit defective. Winding resistances at +15...+30°C: between terminal 1 and 2 : between terminal 3 und 2 :	4, 22	19...25 $\Omega$ 17...22,5 $\Omega$
1 2 6 3	Tank-ventilation valve and control unit (output stage) Note: CAT models only	Fault: short circuit to ground or to batt. +ve. Check lead for contact with ground or batt. +ve; if O.K., control unit defective. Winding resistance at +15...+30°C:	5	35...55 $\Omega$
1 2 7 8 *	Transmission action	Fault: short circuit to ground. Check lead for short circuit to ground, or corresponding output in transmission control unit defective.	51	—
1 2 8 8	Fault lamp and control unit (lamp output stage)	Fault: short circuit to ground or to batt. +ve.	15	

\* = Applies to vehicles with electronic transmission control

## TEST SPECIFICATIONS

Pressure regulator	
Fuel pressure	2,8...3,2 bar
Electric fuel pump	
Delivery	
(measured in return)	at least 950 cm <sup>3</sup> /30s
Supply voltage	
(under load):	at least 12 V

Air-intake temperature sensor	
Internal electrical resistance	
measured in air-flow sensor	
between term. 1 and term. 4	
at ambient temperature	
(+15°C...+30°C):	1450...3300 Ω

Coolant-temperature sensor	
Color of plug, blue. Internal	
electrical resistance	
at ambient temperature	
(+ 15° C...+ 30° C):	1450...3300 Ω
with engine at normal operating temperature	
(approx. +80°C):	280...360 Ω

Solenoid-operated injection valve	
Internal electrical resistance	
at ambient temperature	
(+ 15° C...+ 30° C):	14,5...17 Ω

Air-flow sensor	
Internal electrical resistance between:	
term. 2 and term. 4:	8...2500 Ω (*)
term. 3 and term. 4:	500...1100 Ω

(\*) Slowly deflect the air-flow sensor flap as far as it will go. Resistance fluctuates between the terminal points of the potentiometer.

## TEST SPECIFICATIONS (CONTINUED)

Engine-speed and reference-mark sensor	
Internal electrical resistance	
between term. 1 and term. 2 at	
ambient temperature (+15°C...+30°C):	400...800 Ω
Air gap:	0,8 ± 0,5 mm

Throttle-valve switch	
Resistance value of idle contact	
(term. 2 and term. 18):	0 Ω
Resistance value of full-load	
contact (term. 3 and term. 18):	0 Ω

Idle actuator	
Internal electrical resistance	
at +15°...+30°C between	
term. 1 and term. 2:	19...25 Ω
term. 3 and term. 2:	17...22,5 Ω

Lambda sensor	
Resistance value of heater winding:	1...15 Ω

Ignition coil	
Primary resistance:	approx. 0 Ω
Secondary resistance:	5000...7200 Ω

Interference-suppression resistors	
High-voltage-distributor rotor:	1 k Ω
High-voltage-distributor dome: each	1 k Ω
Spark-plug connector: each	5 k Ω
Spark plugs:	5 k Ω
Ignition coil:	1 k Ω

## TEST SPECIFICATIONS (CONTINUED)

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### High-voltage sensor:

Internal electrical resistance  
between term. 1 and term. 2: approx. 0  $\Omega$

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### Tank-ventilation valve:

(only in vehicles with catalytic converter)

Internal electrical resistance at  
ambient temperature (+15°C...+30°C): 35...55  $\Omega$

---

### Idle test:

Engine at normal operating temperature,  
switch off loads.

Idle speed: 800  $\pm$  40 min<sup>-1</sup>

Spark-advance angle: 10°  $\pm$  5°  
crankshaft

(Automatic transmission to N or P)

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### CO content: without

catalytic converter: 0,5...1,5 % CO by vol.

Adjust mixture at the bypass screw

in the air-flow sensor:

turning to the left makes mixture leaner,

turning to the right makes mixture richer.

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### Vehicles with

catalytic converter: 0,2...1,2 % CO by vol.

(measure CO upstream of the catalytic

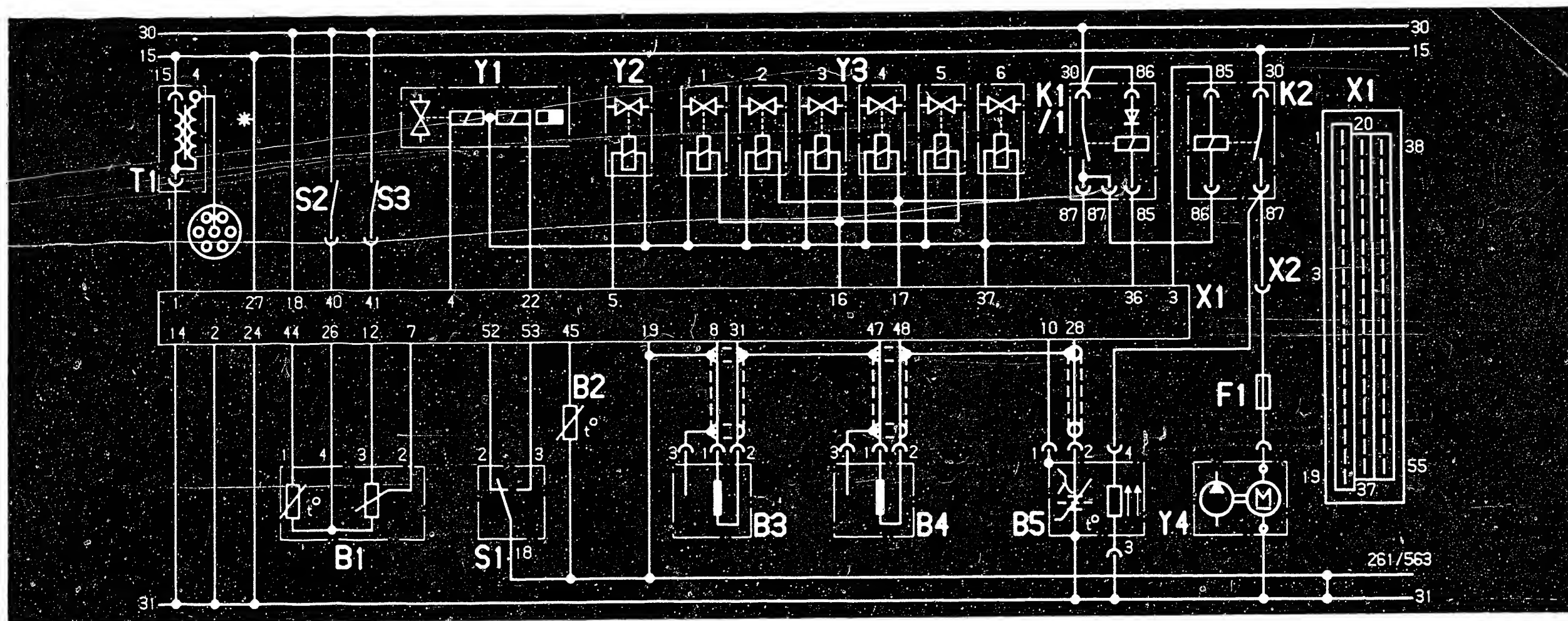
converter if sampling pick-up fitted,

pull apart lambda-sensor plug).

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For production reasons:  
continued on the following  
coordinate.

See equipment and Autodata microcards for  
the settings for valve clearance and other  
engine-related data.

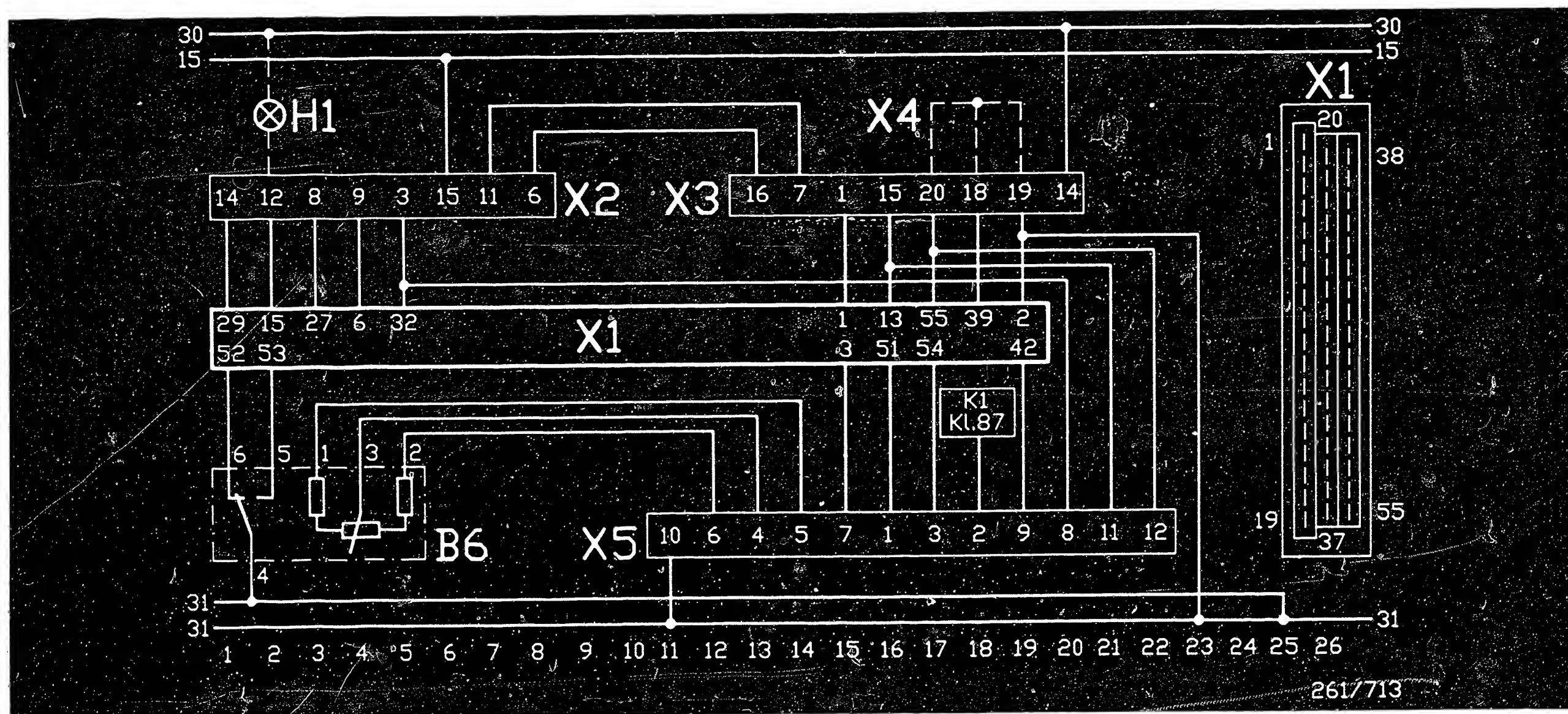


B1 = Air-flow sensor  
 B2 = Engine-temperature sensor  
 B3 = High-voltage sensor  
 B4 = Engine-speed/reference-mark sensor  
 B5 = Heated lambda sensor  
 (Cat only)  
 F1 = Pump fuse  
 K1/1 = Main relay (circuitry  
 as of 12.86)

K2 = Pump relay  
 S1 = Throttle-valve switch  
 S2 = Switch on air-conditioner compressor  
 S3 = Switch on air conditioner  
 T1 = Ignition coil  
 X1 = Motronic control-unit plug  
 Y1 = Idle actuator  
 Y2 = Tank-ventilation valve  
 (Cat only)

Y3 = Solenoid-operated injection valve  
 Y4 = Electric fuel pump  
 \*) = Lead as of FD 652

ELECTRICAL TERMINAL DIAGRAM

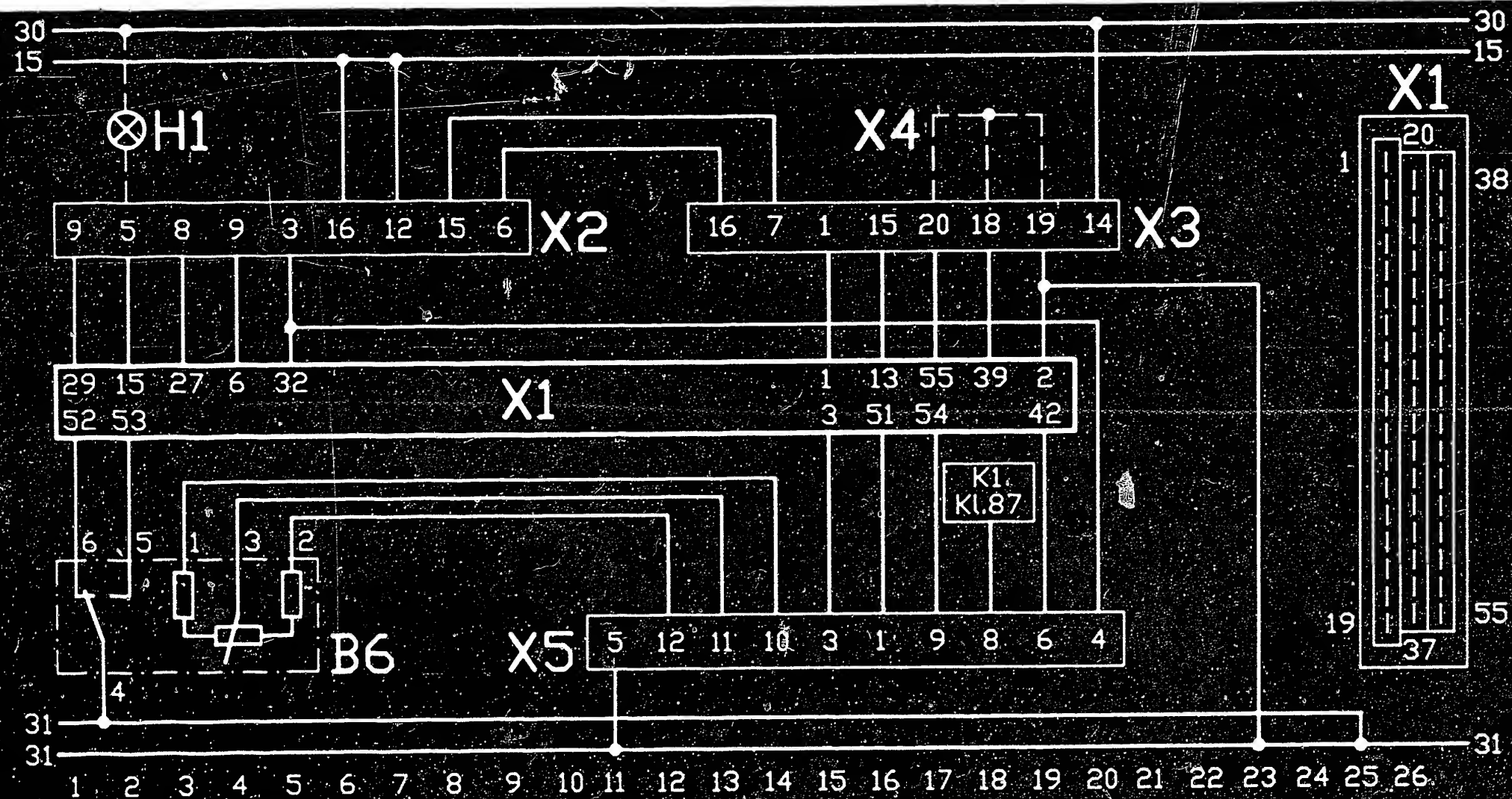


B6 = Throttle-valve switch with pot  
 (on electron. transmission control for Item S1)  
 H1 = "CARB" lamp (fault lamp; US version)  
 X1 = Motronic control-unit plug  
 X2 = Engine plug

X3 = Diagnostic plug  
 X4 = Bridge in diagnostic-plug cover  
 X5 = Plug to transmission control unit

ELECTRICAL TERMINAL DIAGRAM (continued, 6 Series)



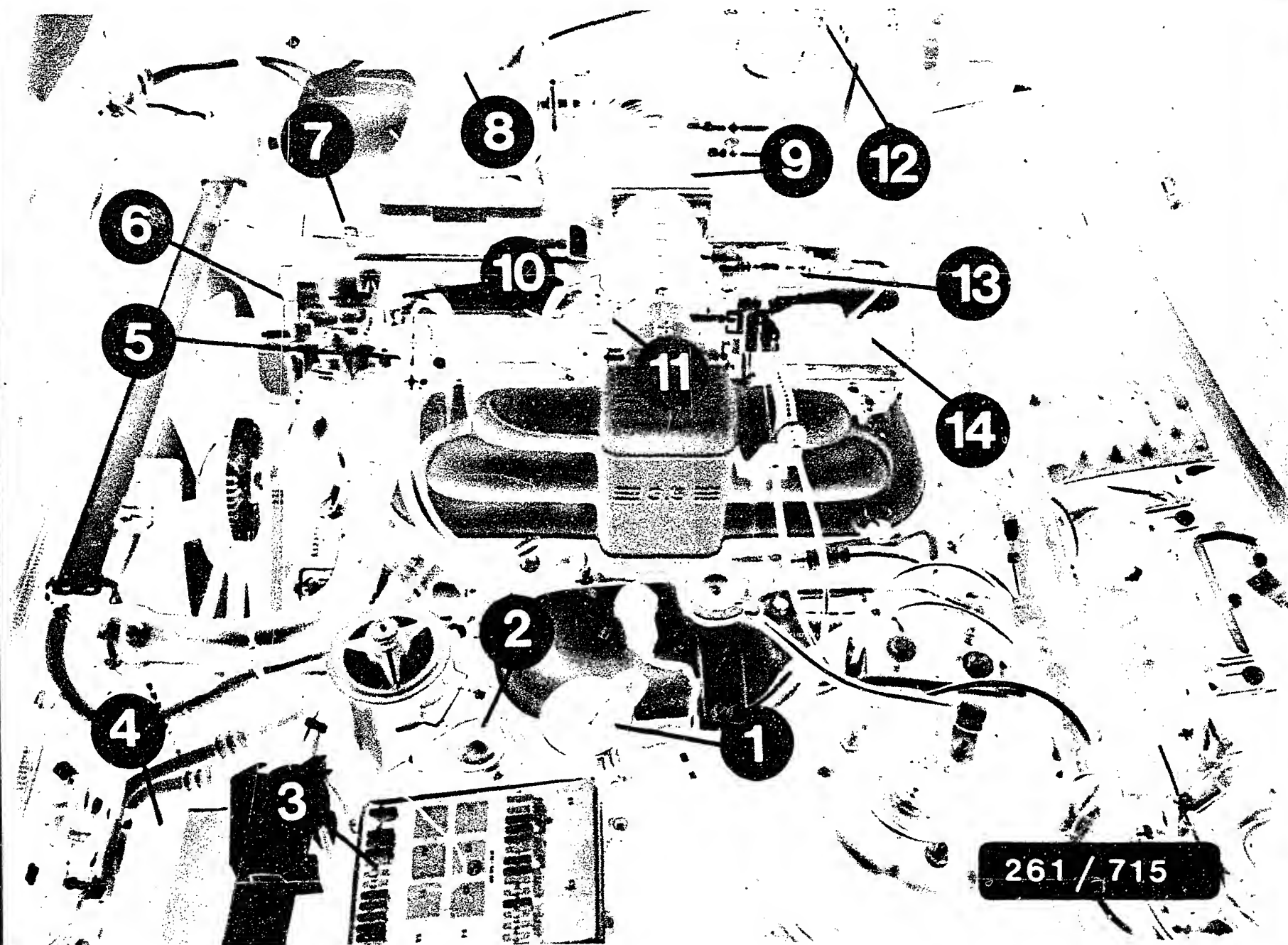


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B6 = Throttle-valve switch with pot  
 (on electron. transmission control for Item S1)  
 H1 = "CARB" lamp (fault lamp; US Version)  
 X1 = Motronic control-unit plug  
 X2 = Engine plug  
 X3 = Diagnostic plug

X4 = Bridge in diagnostic-plug cover  
 X5 = Plug to transmission control unit

ELECTRICAL TERMINAL DIAGRAM (Continued, 5 Series)



- |                             |                                 |                            |
|-----------------------------|---------------------------------|----------------------------|
| 1 = Diagnostic socket       | 6 = High-voltage distributor    | 11 = Throttle-valve switch |
| 2 = Engine plug             | 7 = High-voltage sensor         | 12 = Ground terminal       |
| 3 = Fuse box                | 8 = Ignition coil               | 13 = Idle actuator         |
| 4 = Battery                 | 9 = Air-flow sensor             | 14 = Cover over the        |
| 5 = Fuel-pressure regulator | 10 = Coolant-temperature sensor | injection valves           |

#### INSTALLATION POSITION OF COMPONENTS

Note: The illustration shows the BMW 635 CSi. The installation positions in the BMW 535 i and M 535 i are similar.



## INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The high-voltage sensor is pushed on to the H.T. lead of cylinder 6, see upper illustration, Item 1.

The engine-speed/reference-mark sensor is located on the engine at the front, to the right of the crankshaft ring gear, see upper ill., Item 2.

Plug-in connection of the engine-speed/reference-mark sensor:  
On the fuel-distribution pipe, center illustration, Item 1.

Plug-in connection of the high-voltage sensor:  
On the fuel-distribution pipe, centre illustration 2.

Lower illustration:

The fuel-pump relay, Item 1, (color: orange) and the main relay Item 2 (color: white) are located beneath a cover on the fuse box.

The fuse No. 11 for the electric fuel pump is located in the fuse box (lower illustration, Item 3).

The Motronic control unit is located in the glove compartment above a plastic cover.

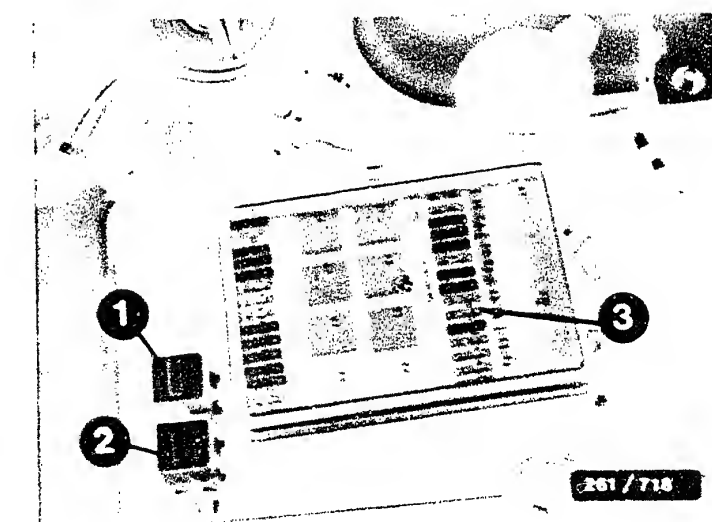
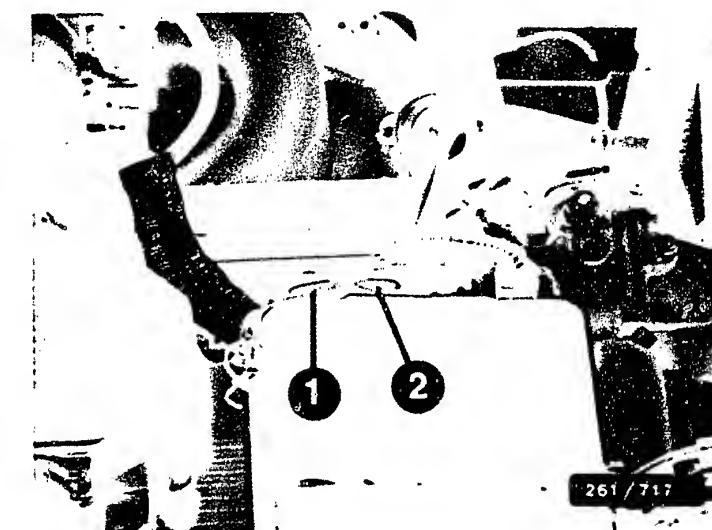
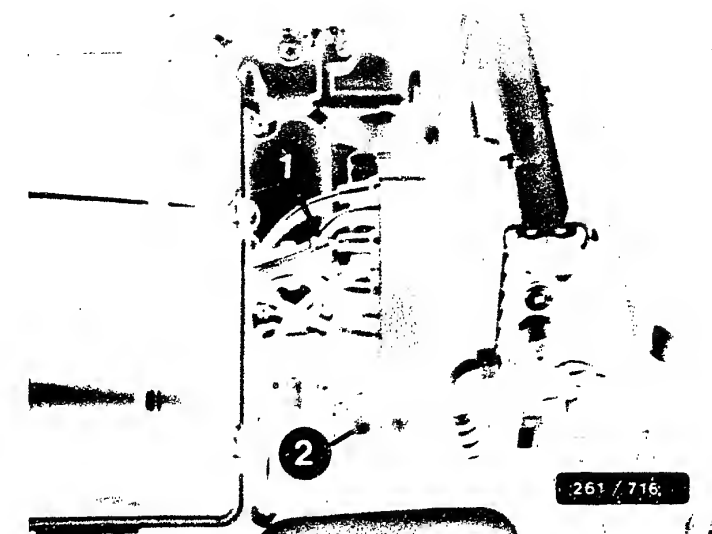
Lambda sensor: in the common exhaust pipe.

Tank-ventilation valve (only in vehicles with catalytic converter):  
beneath the throttle-valve assembly.

Fuel filter and electric fuel pump:

Beneath the vehicle, on the right-hand side as seen in the forward direction of travel, in front of the tank

Air-intake temperature sensor and CO adjusting screw:  
In the air-flow sensor.



Trouble-shooting instructions : ALF-5007  
BOSCH system : L-Jetronic-Jetronic  
Make of vehicle : ALFA-ROME0  
Basic microcard : FIA-01/J22

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following vehicle models:

ALFA ROMEO 75 2.5 V6 Milano USA 02.86->  
ALFA ROMEO 90 2.5 V6 Iniezione  
AUS, CH, D, USA 02.86->  
ALFA ROMEO 75 3.0 V6 Iniezione USA 10.86->  
ALFA ROMEO GTV 6 3.0 Iniezione USA 10.86->  
with 2.492 l / 6-cyl. engine or  
2.959 l / 6-cyl engine

- \* L-Jetronic with 35-pin control unit:  
0 280 001 132 or 0 280 001 134.
- \* Engine-speed triggering by term. 1 of ignition coil.
- \* 7-pin air-flow sensor with pump contact.
- \* 13-pin relay set.
- \* 2.5  $\Omega$  solenoid-operated injection valves,  
control unit with current-controlled output stage.
- \* Starting enrichment by means of cold-start valve  
and thermo-time switch.
- \* Pressure sensor for altitude compensation.
- \* Lambda closed-loop control with heated sensor.
- \* No test lead from term. 22 to engine compartment  
for integrator voltage measurement.
- \* Testing of lambda closed-loop control via CO  
measurement before the catalytic converter.  
If required, use Alpha adapter C 20051.
- \* 3-way catalytic converter.
- \* For testing the fuel pressure, connect pressure  
tester with 3-way line KDJE-P 100/13  
to cold-start valve.

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults. For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

**CAUTION!**  
High-performance ignition system with  
dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

\* When testing the compression, avoid the injection of fuel.  
Therefore, disconnect relay set.

For further precautionary measures,  
see basic instructions.

## Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling  
(Engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring  
(ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

										Cause (component fault)
*	*	*	*	*	*	*	*	*	*	Universal test adapter
*										Electric fuel pump
*	*	*	*							Auxiliary-air device/idle actuator
*	*	*	*	*	*	*	*	*		Air-flow sensor/air-mass sensor
*	*	*	*		*					Intake system
		*	*	*		*	*			Solenoid-operated injection valves
*	*	*			*	*				Fuel pressure
				*	*					Fuel delivery
		*	*	*	*	*				Throttle valve
*	*	*				*				Cold-start valve
*		*								Thermo-time switch
				*						Frame connection
*	*	*	*	*	*					Alternator, interference suppress
		*	*	*		*				CO exhaust-gas adjustment
				*						Control unit
						*				Catalytic converter
		*	*	*	*					Lambda closed-loop control

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01  
 Adapter lead: 1 684 463 129

Test step	switch V	$\Omega$	Term- inals	Testing of component/function	Test instructions / Test conditions	Set values
1	3	-	4 - 5 (+) (-)	Voltage from ignition and starting switch term. 50	Shift into neutral, start engine	8...15 V
2	4	-	34 - 5 (+) (-)	Voltage from relay set term. 88c via auxiliary-air device	Shift into neutral, start engine	8...15 V
3	5	-	1 - 5 (+) (-)	Voltage pulses from ignition coil term. 1	Shift into neutral, start engine	Ignition pulses on oscilloscope
4	6	-	10 - 5 (+) (-)	Voltage from relay set term. 88a	Switch on ignition	8...15 V
5	7	-	15 - 5 (+) (-)	Voltage of injection valve 1	Switch on ignition	8...15 V
6	8	-	33 - 5 (+) (-)	Voltage of injection valve 2	Switch on ignition	8...15 V
7	9	-	32 - 5 (+) (-)	Voltage of injection valve 3	Switch on ignition	8...15 V
8	10	-	14 - 5 (+) (-)	Voltage of injection valve 4	Switch on ignition	8...15 V
9	11	-	20 - 5 (+) (-)	Voltage over pump contact in air-flow sensor from relay set term. 86b	Switch on ignition	8...15 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (Continued)  
 Adapter lead: 1 684 463 129

Test step	switch V	$\Omega$	Term- inals	Testing of component/function	Test instructions / Test conditions	Set values
10	12	-	29 - 5 (+) (-)	Voltage from relay set term. 88b	Switch on ignition	8...15 V
11	13	-	30 - 5 (+) (-)	Voltage of injection valve 5	Switch on ignition	8...15 V
12	14	-	31 - 5 (+) (-)	Voltage of injection valve 6	Switch on ignition	8...15 V
13	 V	6	7 - 5	Resistance value of potentiometer wiper in air-flow sensor	Deflect air-flow sensor flap as far as it will go	80...600 $\Omega$
14	 V	7	8 - 5	Resistance value of potentiometer (total) in air-flow sensor		260...520 $\Omega$
15	 V	8	9 - 5	Resistance value of both resistors in series in air-flow sensor	Disconnect 3-pin cable connector from pressure sensor (altitude sensor).	400...800 $\Omega$
16	 V	9	2 - 18	Resistance value of idle contact	Connect cable connector on to pressure sensor. Disconnect EI control-unit plug. Accelerator pedal in idle position: Slightly depress accelerator pedal:	0...10 $\Omega$ infinity $\Omega$
17	 V	10	3 - 18	Resistance value of full-load contact	EI control-unit plug remains disconnected. Accelerator pedal in idle position: Depress accelerator pedal to floor.	infinity $\Omega$ 0...10 $\Omega$

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (Continued)  
Adapter lead: 1 684 463 129

Test step	switch		Term-inals	Testing of component/function	Test instructions / Test conditions	Set values
	V	$\Omega$				
18	 V	11	27 - 5	Resistance, temperature sensor (air intake)	+15...30 °C :	1.45...3.3 k $\Omega$
19	 V	12	13 - 5	Resistance, temperature sensor (engine)	+15...30 °C : approx. +80 °C :	1.3...3.6 k $\Omega$ 250...390 $\Omega$
20	 V	13	16 - 5	Frame connection of output stage		0...10 $\Omega$
21	 V	14	17 - 5	Frame connection of output stage		0...10 $\Omega$
22	 V	15	35 - 5	Frame connection of output stage		0...10 $\Omega$
23	 V	8	9 - 5	Resistance value of pressure sensor	Disconnect 7-pin cable connector from air-flow sensor.	2.3...2.8 k $\Omega$
24	 V	19	12 - 5	Resistance value of pressure sensor, wiper	at 977 mbar (approx. 300 m altitude): at 616 mbar (approx. 4000 m altitude): After measuring, reconnect 7-pin cable connector to air-flow sensor.	2.0...2.5 k $\Omega$ 2.2...2.7 k $\Omega$

REMARK: Following components with corresponding connecting leads are not covered by the universal test adapter when testing:

- |                          |  |  |
|--------------------------|--|--|
| 1. Electric fuel pump/n: | Positive lead from term. 88d of relay set,                 | negative lead to vehicle ground.           |
| 2. Sensor heater:        | Positive lead from term. 88c of relay set,                 | negative lead to engine ground.            |
| 3. Lambda sensor:        | Sensor lead to ctrl. unit term.24 (shielding at term. 23), | sensor housing to vehicle ground.          |
| 4. Cold-start valve:     | Positive lead from term. 86 of relay set,                  | neg. lead to thermo-time switch term. W.   |
| 5. Thermo-time switch:   | At term. G pos from term. 86 of relay combination,         | thermo-time switch housing to eng. ground. |

## TEST SPECIFICATIONS

Component/function	Set values
Electric fuel pump	
* Fuel delivery at return	
2.5l-engine:	at least 800 cm <sup>3</sup> /30 s.
3.0l-engine:	at least 900 cm <sup>3</sup> /30 s.
* Supply voltage under load:	at least 12 V
In-tank pre-supply pump (if fitted)	
* Fuel delivery	
2.5l-engine:	at least 900 cm <sup>3</sup> /30 s.
3.0l-engine:	at least 1000 cm <sup>3</sup> /30 s.
Pressure regulator	
* Fuel pressure:	
with engine at standstill:	2,3 ... 2,7 bar
at idle:	approx. 0.5 bar lower
Fuel system, leakages	
* Fuel pressure after 20 mins. with engine at standstill:	at least 1.0 bar
Temperature sensor (air intake) at air-flow sensor at term. 6 and term. 27	
* Internal electrical resistance at ambient temperature +15...+30°C :	1,45...3,3 k Ω
Temperature sensor (engine)	
* Internal electrical resistance at ambient temperature +15...+30°C :	1,3 ... 3,6 k Ω
With eng. at norm op. temp. approx. +80°C :	250 ... 390 Ω

C11

## TEST SPECIFICATIONS (Continued)

Component/function	Set values
Auxiliary-air device	
* Internal electrical resistance:	25...60 Ω
Air-flow sensor	
* Resistance between	
term. 6 and term. 9:	400...800 Ω
term. 6 and term. 8:	260...520 Ω
term. 6 and term. 7:	
(Fully deflect air-flow sensor flap)	80...600 Ω
term. 7 and term. 8:	200...1000 Ω
term. 8 and term. 9:	140...280 Ω
Solenoid-operated injection valve	
* Internal electrical resistance at ambient temperature +15...+30°C:	2,0...3,0 Ω
* Leakage after 60 s:	no drop must fall
Pressure sensor (altitude sensor)	
* 300 m altitude (977mbar):	2,0...4,0 V
4000m altitude (616mbar):	8,0...12,0 V
Resistance between	
term. 2 (-) and term. 3 (+):	2,3...2,8 k Ω
Relay set	
* Electrical resistance between term. 85 and term. 86b:	70...500 Ω

C12

## TEST SPECIFICATIONS (Continued)

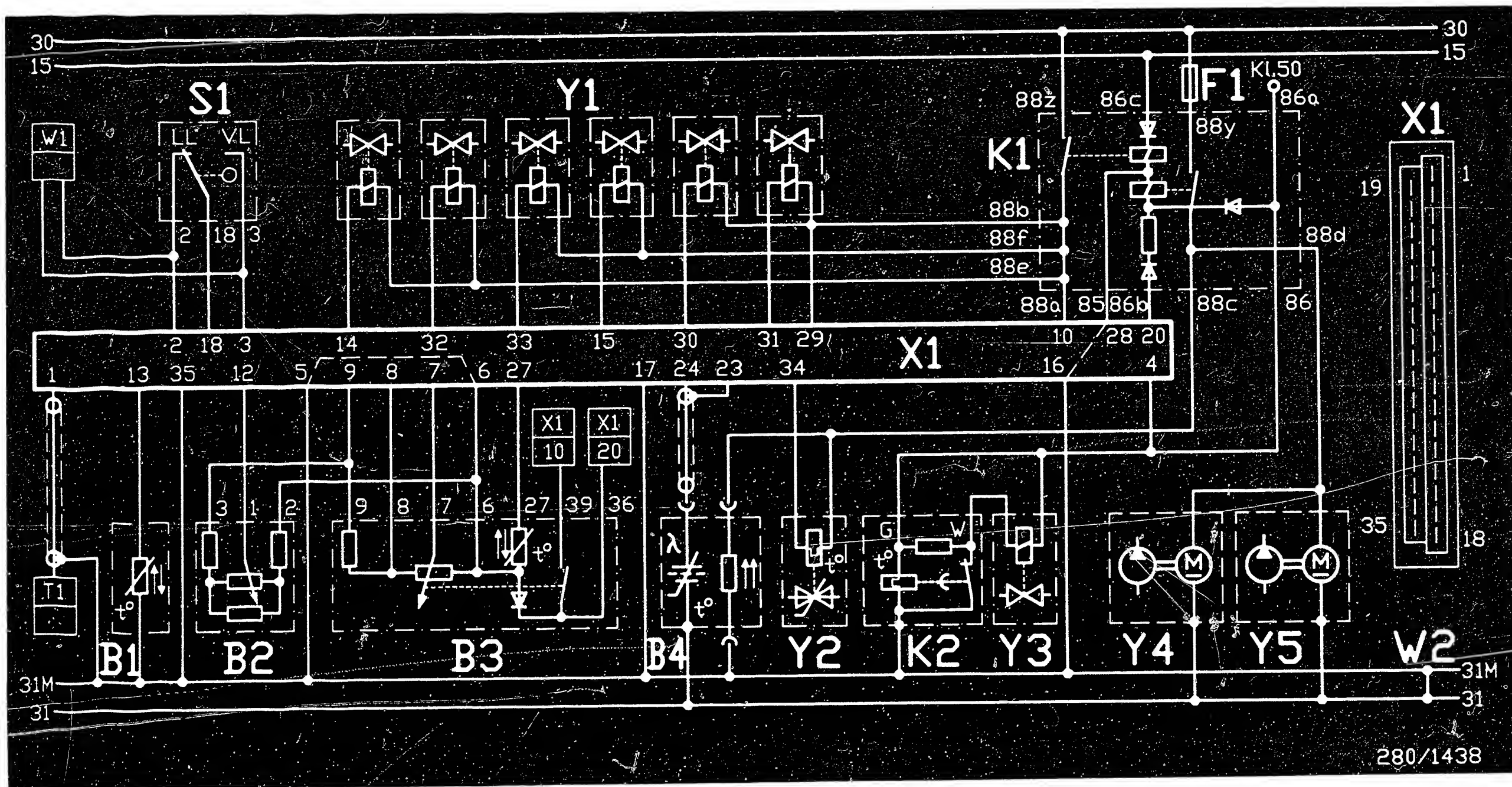
Component/function	Set values	
Thermo-time switch 35° / 8 s		
* Internal electrical resistance between:	below +30°C	above +40°C
Terminal G and ground:	25... 40 Ω	50... 80 Ω
Terminal W and ground:	0 Ω	100...160 Ω
Terminal G and terminal W:	25... 40 Ω	50... 80 Ω
Cold-start valve		
* Internal electrical resistance:	3,5...4,5 Ω	
* Leakage, maximum permissible:	1 drops/min.	
Lambda-sensor heater		
* Internal electrical resistance (PTC) with engine at standstill:	1...15 Ω	
Idle adjustment		
* Idle speed		
Manual and automatic transmission:	800...1000 min <sup>-1</sup>	
* CO content:	0,5...0,7 % by vol.	
Measuring location before catalytic converter.		
Pull apart lambda-sensor plug and disconnect tank-ventilation hose.		
If required, use Alfa Romeo Adapter C 20051.		
Connect sensor plug:	engine speed and CO must remain unchanged.	

## TEST SPECIFICATIONS (CONTINUED)

Component/function	Set values
Lambda closed-loop control	
Allow engine at operating temperature to idle. Detach tank-ventilation hose. Measure CO-content ahead of catalytic converter.	
* Rich value	CO-content
Disconnect Lambda sensor plug and connect control-unit end to ground:	increases to above 0,7 vol. %
Only perform measurement briefly.	
* Lean value	
Apply 2 V to control-unit end of sensor lead:	drops below 0,5 vol % Engine does not run smoothly
* Closed-loop control value	
Connect sensor plug. Attach tank-ventilation hose:	0,4...0,8 vol %
Detach intake-manifold pressure actuator (air hose) at pressure regulator:	briefly increases and drops back to closed-loop control value above
Switch off suction plant during exhaust-emission measurement and adjustment.	

See equipment and Autodata microcards for settings as regards ignition, valve clearance and other engine-related data.



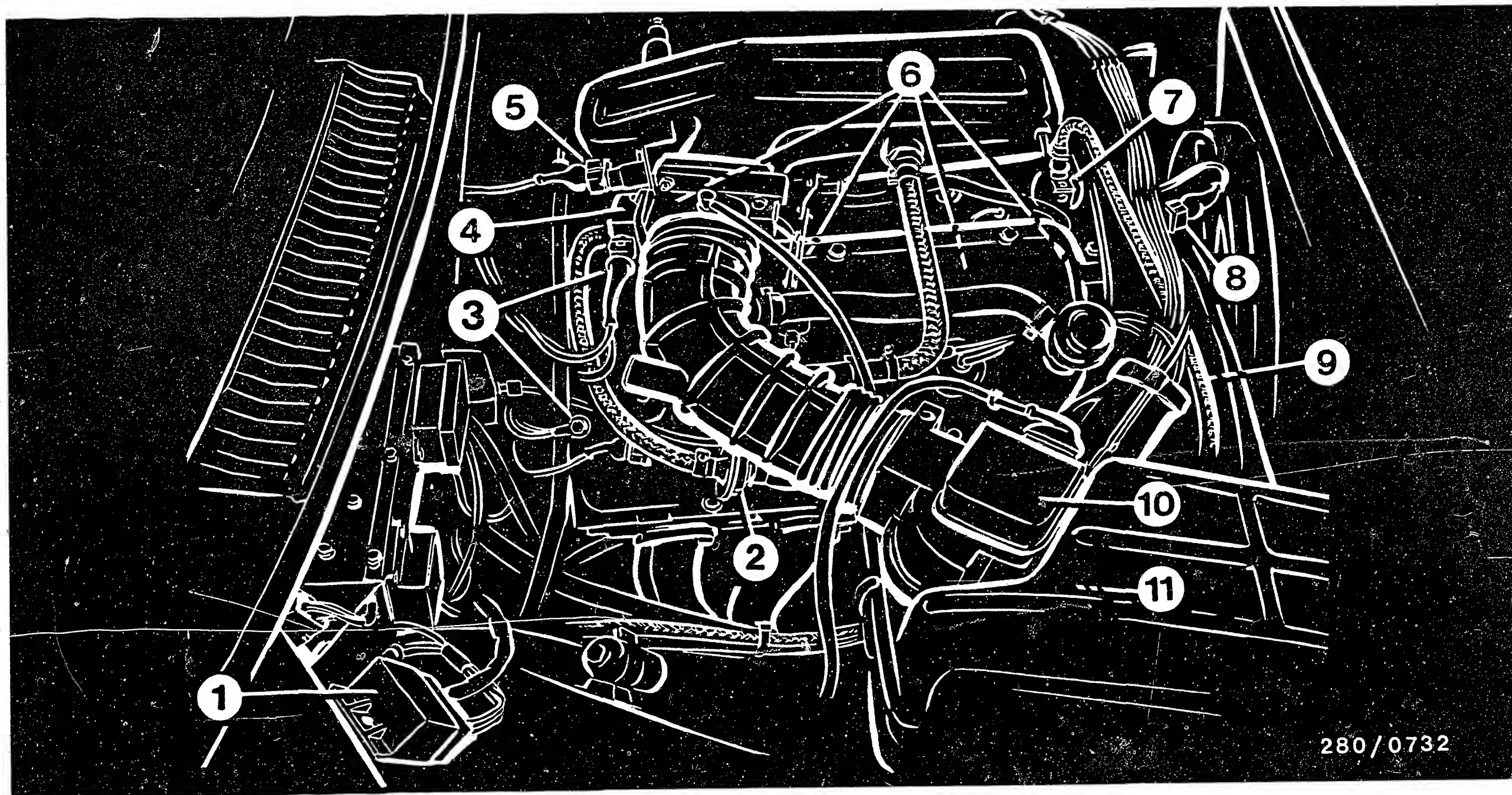


# ELECTRICAL TERMINAL DIAGRAM

B1 = Temperature sensor (engine)  
B2 = Pressure sensor (alt. sensor)  
B3 = Air-flow sensor  
with pump contact  
B4 = Heated lambda sensor  
F1 = Pump fuse

K1 = Relay set  
K2 = Thermo-time switch  
S1 = Throttle-valve switch  
T1 = From ignition coil  
W1 = To EI control unit  
W2 = Ground strap, engine

X1 = Control-unit plug  
Y1 = Solenoid-operated injection valves  
Y2 = Auxiliary-air device  
Y3 = Cold-start valve  
Y4 = Electric fuel pump  
Y5 = In-tank pre-supply pump



280/0732

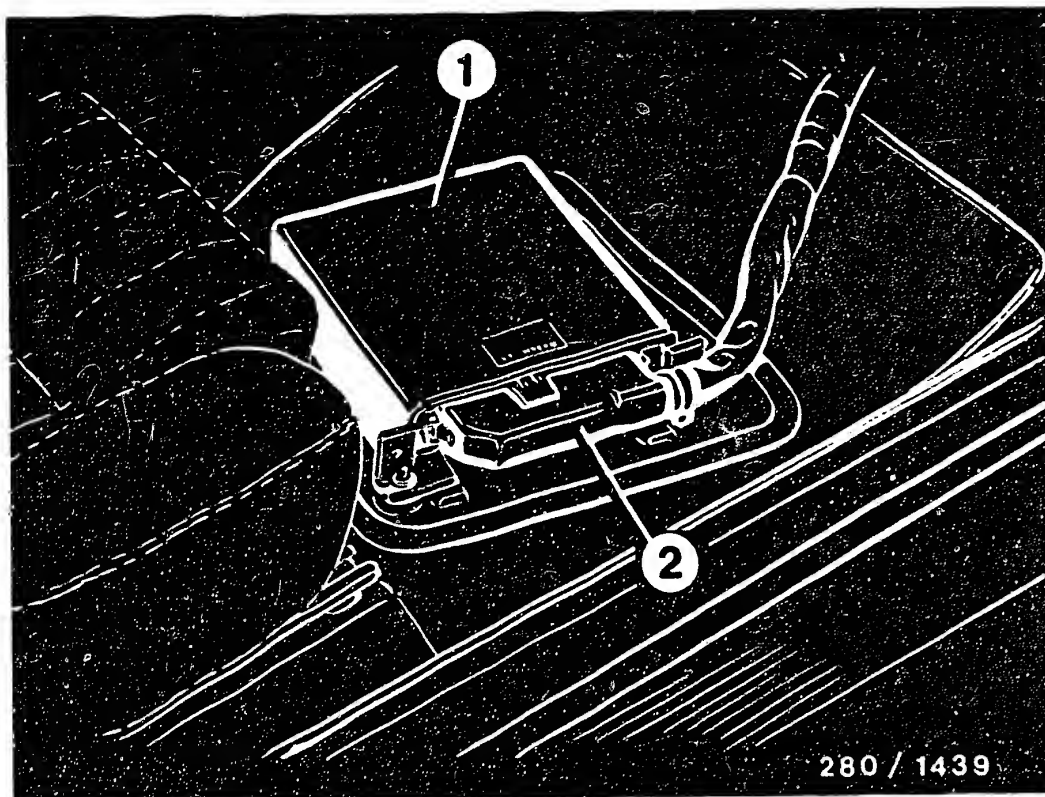
1 = Relay set  
 2 = Auxiliary-air device  
 3 = Central ground in GTV,  
 at auxiliary-air device in 75

4 = Throttle-valve switch  
 5 = Cold-start valve  
 6 = Solenoid-operated injection valves  
 7 = Pressure regulator

8 = Temperature sensor (engine)  
 9 = Thermo-time switch  
 10 = Air-flow sensor  
 11 = Air filter

# INSTALLATION POSITION OF COMPONENTS (CONTINUED)

\* Layout of components on the engine



1 = Control unit  
2 = 35-pin control-unit plug

#### INSTALLATION POSITION OF COMPONENTS

The indications "right" and "left" always refer to the forward direction of travel.

##### \* L-Jetronic control unit

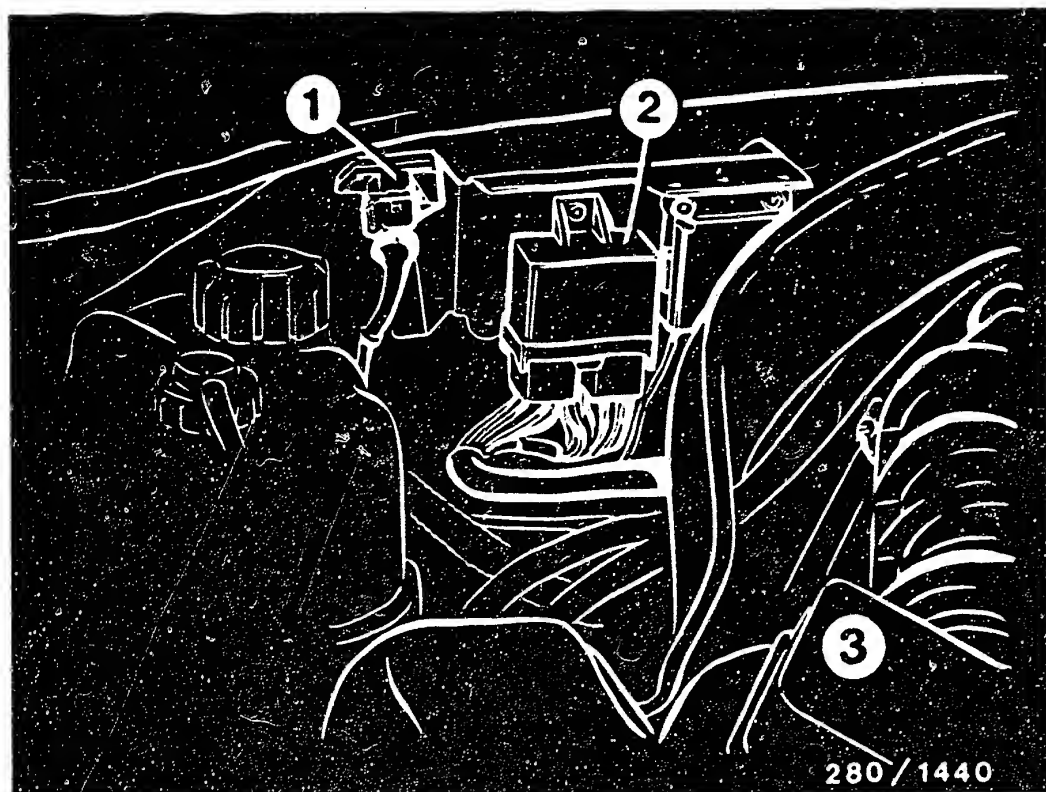
The control unit is located in the passenger compartment beneath the glove compartment.

To remove, remove panelling and loosen fastening screws on the control unit.

For testing electrically using universal test adapter, press open latch (locking tong) and disconnect control-unit plug. Connect 35-pin adapter lead to periphery.

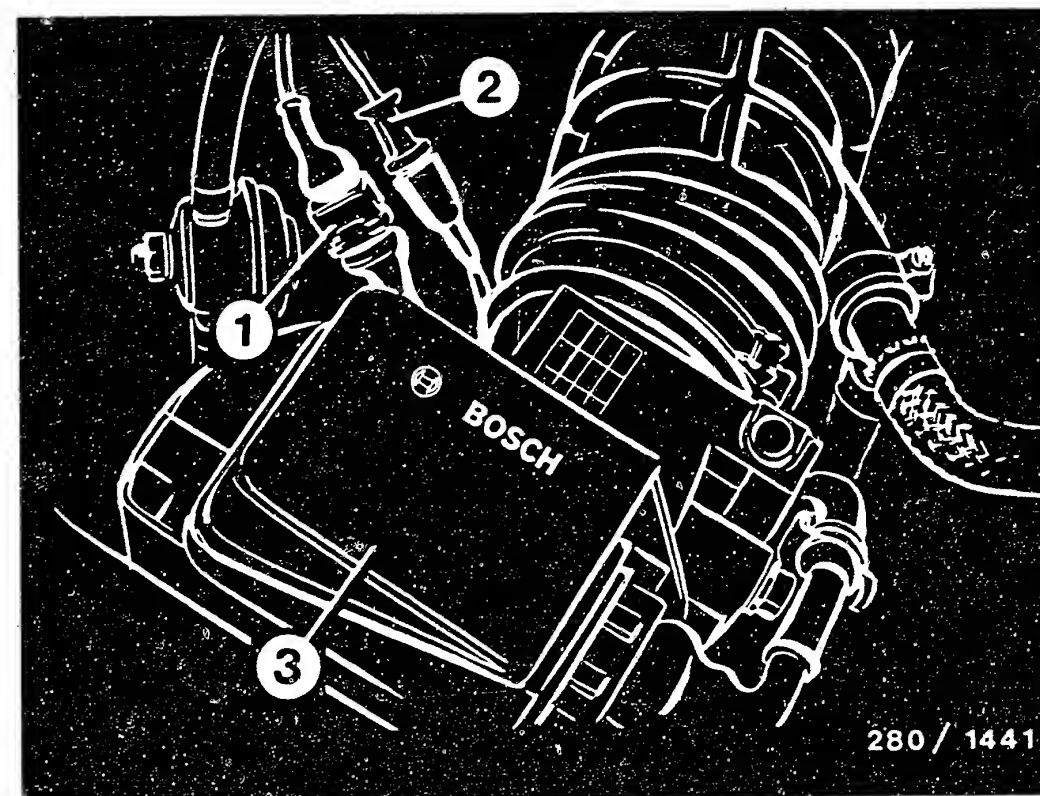
#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- \* Electric fuel pump on vehicle floor panel in front of the rear axle.
- \* In-tank pre-supply pump is accessible via a locking ring on the fuel tank.
- \* Fuel filter on vehicle floor panel in front of the rear axle.
- \* Heated lambda sensor in exhaust pipe upstream of the catalytic converter.
- \* CO sampling pickup in screw plug upstream of the catalytic converter.



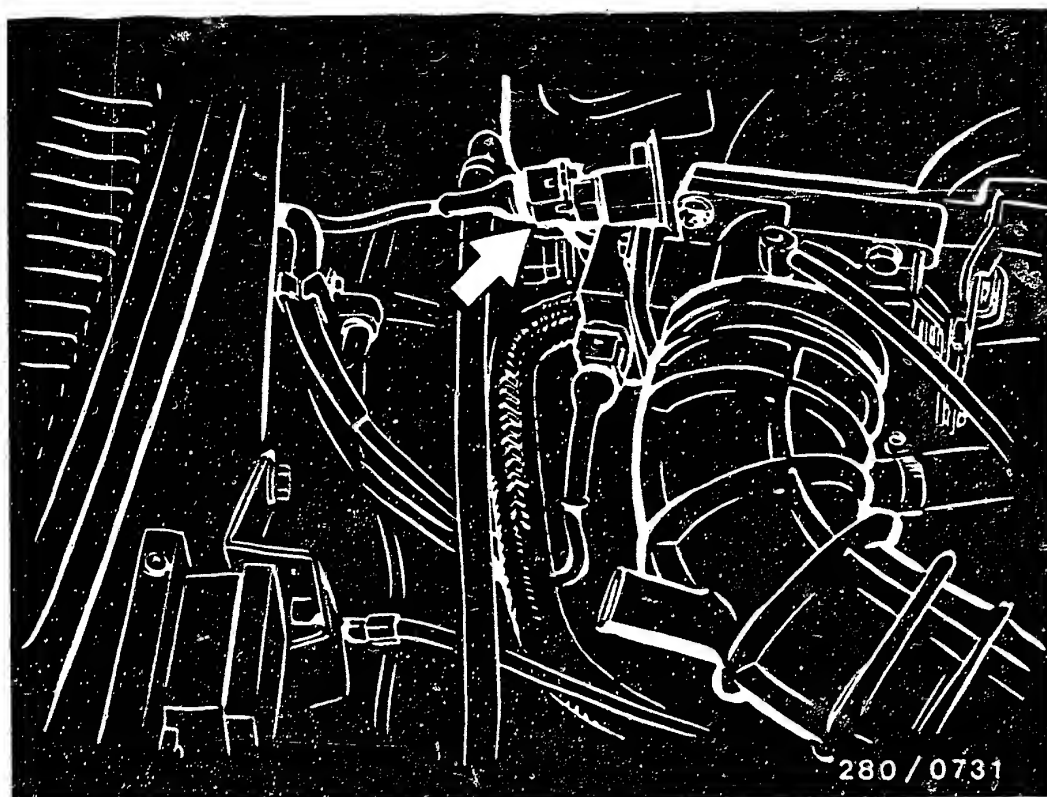
- 1 = Pressure sensor (altitude sensor)
- 2 = Relay set
- 3 = Air-flow sensor

INSTALLATION POSITION OF COMPONENTS (CONTINUED)



- 1 = Plug-in connection - sensor heater
- 2 = Plug-in connection - sensor signal
- 3 = Air-flow sensor

INSTALLATION POSITION OF COMPONENTS (CONTINUED)



Arrow = Cold-start valve

# TESTING THE FUEL PRESSURE

Disconnect hose from the cold-start valve (arrow).

Connect pressure gauge.  
Do not damage the cold-start valve when disconnecting and connecting the fuel pressure hose.

Make sure all connections are tight.

For production reasons:  
continued on the following  
coordinate.





## TEST REQUIREMENTS FOR TESTING WITH ABS2 LED TESTER

- \* Regulatory tire size fitted?
- \* Check for firm seating of ground of return-supply pump.
- \* Check for firm seating and corrosion of ground of overvoltage-protection relay term. 31.
- \* Check for firm seating of ground strap between engine block and vehicle frame.
- \* Check for leaks in hydraulic connections at hydraulic modulator and sealing points (visual examination).
- \* If the ABS warning lamp lights up intermittently when driving (e.g. after switching on loads) and goes out again by itself, check the battery and power supply (alternator, regulator and voltage drops).
- \* If the ABS warning lamp lights up constantly and does not go out, check the following points:
  - Controller plug sitting correctly on controller and latched?
  - All plug contacts O.K.?
  - Spring contacts latched?
  - Check installation position for correct seating of seal ring in controller plug, rounded side downward.

- Check wheel-speed-sensor leads for correct assignment at controller plug:

### Wheel-speed sensors:

front left to term. 5 and term. 4.  
front right to term. 23 and term. 21.  
rear left to term. 7 and term. 9.  
rear right to term. 24 and term. 26.  
rear axle to term. - and term. -.

- V-belt snapped?  
(Alternator provides no voltage, charge-indicator lamp and ABS warning lamp light up).
- \* Connect ABS 2 LED tester to ABS wiring harness.
- Disconnect and connect controller only with ignition switched off.
- For testing, switch on ignition in all program-selector-switch positions (tester operates with current supply from vehicle battery).
- Observe LED (green) for current supply in all program-selector-switch positions.

## C A U T I O N !

Do not drive with tester connected!

The brake system must be bled of air before the ABS test. Do not activate the ABS tester while the system is being bled.

Repeat the complete test program after any repairs are carried out.

The Antiskid System is a vehicle safety system.

Work on the system demands detailed knowledge of the system.

The conventional brake system must be O.K.

## General information for trouble-shooting:

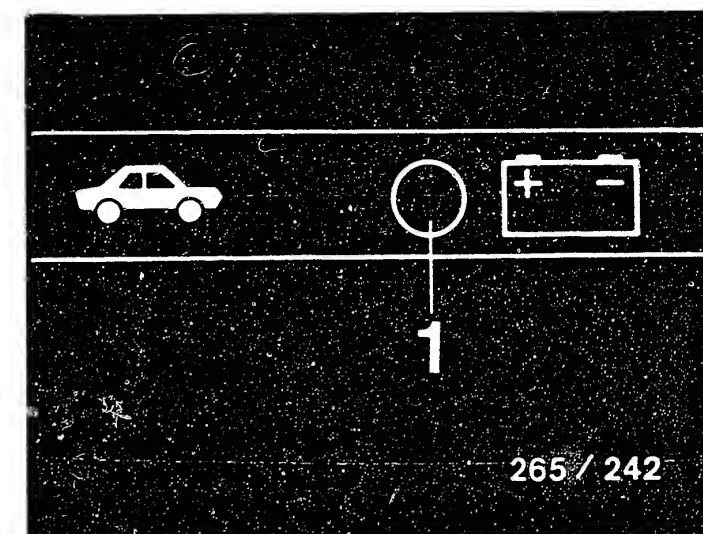
Check all leads for short circuit to ground and contact with positive leads and watch out for worn cable insulation and pinched leads.

# RAPID DIAGNOSIS CHART

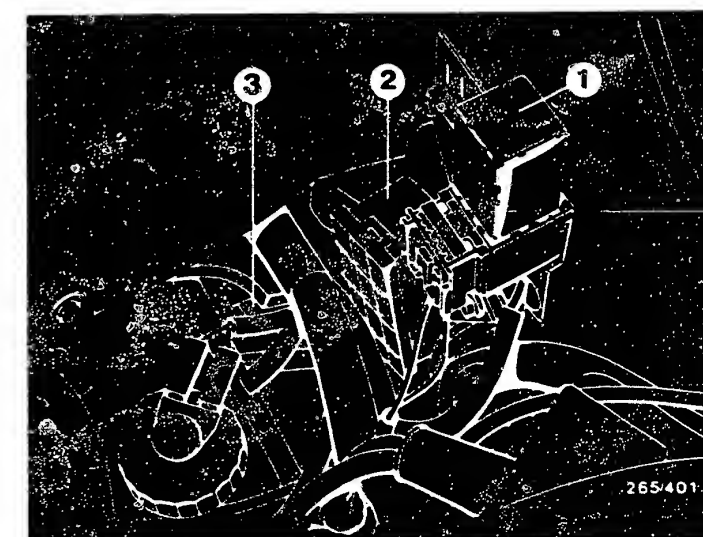
Do not drive with tester connected. Are all test conditions met?

Program-switch positions 1 to 6

Testing of (measurement at terminals)	Additional operation	Test specifi- cation (reading)	Possible causes of faults
Power supply  (term.1 und term.20)	Ignition on	LED 1 (top picture) continuously lit	<p>*Battery insufficiently charged</p> <p>*High voltage drops</p> <p>*Overvoltage-protection relay defective</p> <p>*Check lead to driving switch term.15</p>



- 1 = Overvoltage-protection relay
- 2 = Socket with positive and ground terminals
- 3 = Wheel-speed-sensor plug-in connection

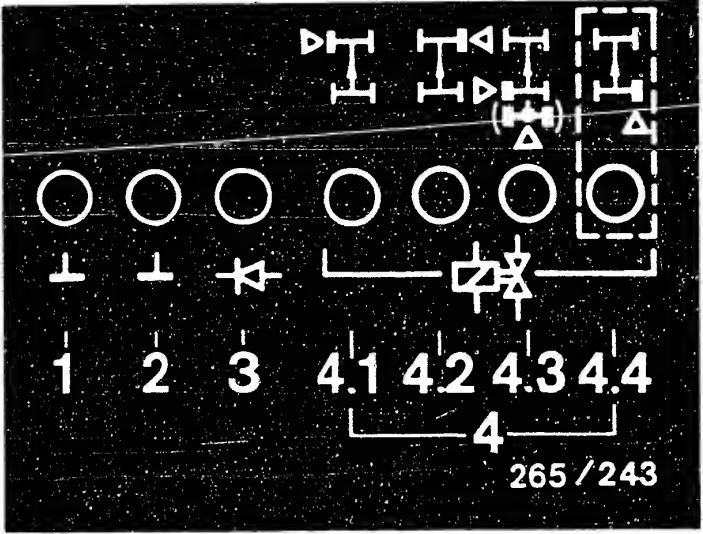




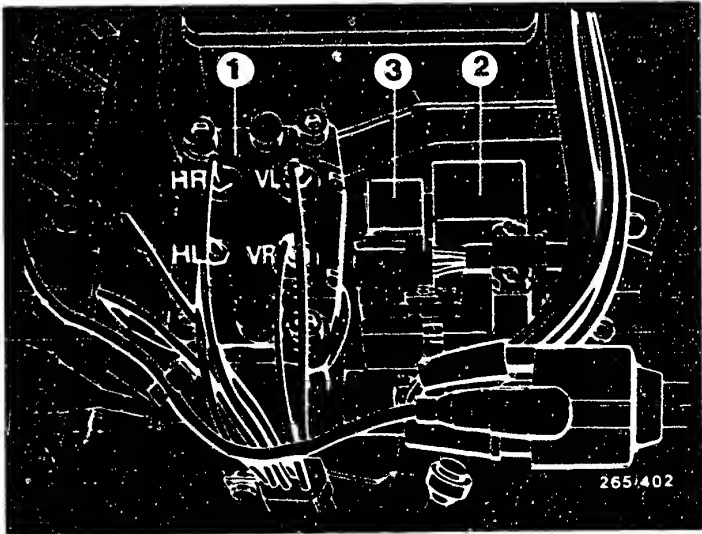
RAPID DIAGNOSIS CHART (CONTINUED)

Program-switch position 1 (4-channel hydraulic modulator)

Testing of (measurement at terminals)	Addition- al operation	Test specifi- cation (reading)	Possible causes of faults
Ground connection (term.10, term.34)  Diode for warning lamp (term.29, term.32) Solenoid-operated valve internal res. (term.2, term.18, term.19, term.35)  Off-position and ground connection of relay  ABS warning lamp	Ignition on	7 LED (1 to 4.4)  simultaneously brightly lit (top picture)  ABS warning lamp in vehicle must light up	<ul style="list-style-type: none"><li>* LED 1 and/or 2 (top picture) not lit:  Check ground terminals for open circuit.</li><li>* LED 3 (top picture) not lit: Diode defective, check ground connection of valve relay.</li><li>* One or more LEDs 4 not lit: Check corresponding plug-in connection for solenoid- operated valve and leads.</li><li>Solenoid-operated valve internal resistance 0,7...1,7 <math>\Omega</math></li><li>* All LEDs 4 and LEDs 3 not lit: Check ground connection of valve relay, valve relay defective.</li><li>* Dimmer lighting-up of an LED means contact resistance in the corresponding circuit.</li><li>* ABS warning lamp not lit: Warning lamp defective. Note: all other 6 LEDs lit.</li></ul>



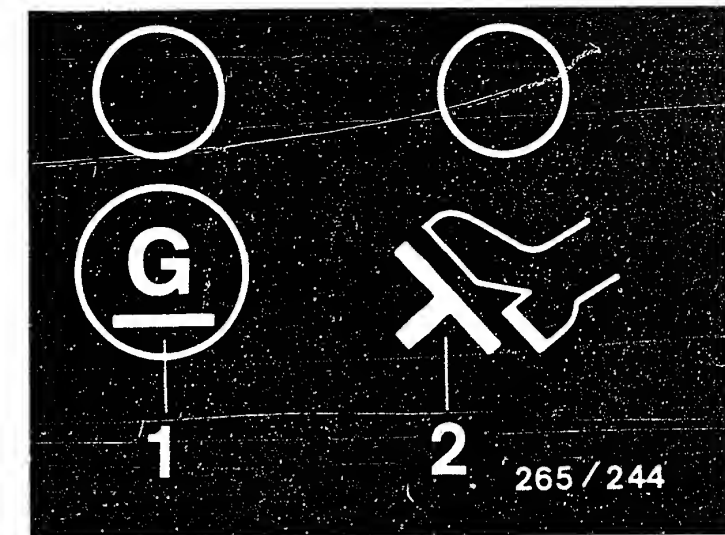
1 = Hydraulic modulator  
2 = Motor relay  
3 = Valve relay



# RAPID DIAGNOSIS CHART (CONTINUED)

Program-switch position 2

Testing of (Measurement at terminals)	Additional operation	Test specification (reading)	Possible causes of faults
Alternator voltage from term.61 (term.15)	Ignition on	LED 1 (top picture) lit.	* In some cases, LED does not go out until after burst of throttle (test is O.K. in this case).
	Start engine	LED 1 (top picture) goes out when engine running	* Check lead to alternator term.61  * Alternator defective.
Stop-lamp switch (term.25)	Ignition on	LED 2 (top picture) lit	* Stop-lamp switch defective.  * Check lead to stop-lamp switch.
	Press brake pedal	LED 2 (top picture) goes out	* Lead incorrectly connected to to stop-lamp switch.

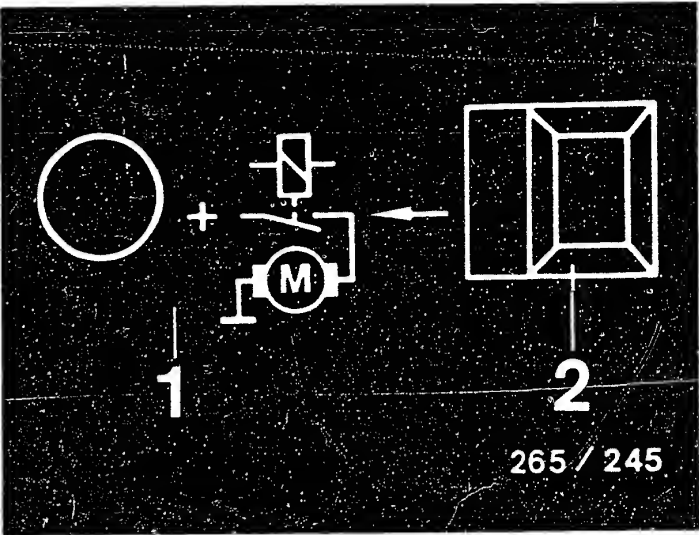


RAPID DIAGNOSIS CHART (CONTINUED)

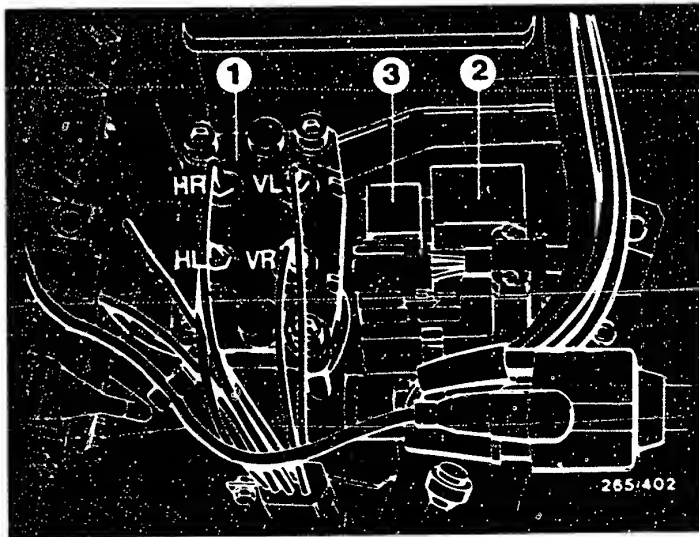
Program-selector-switch position 3

Under test (measurement at the terminals)	Additional operation	Test specifications (reading)	Possible causes of trouble
Motor relay, pump motor in hydraulic modulator (term.14 and term.28)	Ignition on, constantly press push- button 2 (upper ill- ustration)	LED 1 lights up, pump motor runs.  After releasing push-button, LED stays lit due to run-on of motor (upper illustration).	<ul style="list-style-type: none"><li>* Motor relay defective</li><li>* Check frame connection and positive terminal of pump motor</li><li>* Check following leads: from controller term. 14 and term. 28 to hydraulic modulator term. 9 or term. 11. Positive lead to hydraulic modulator term. 2.</li><li>* Pump motor or hydraulic modulator defective.</li></ul>

Program-selector-switch position 4 not applicable.

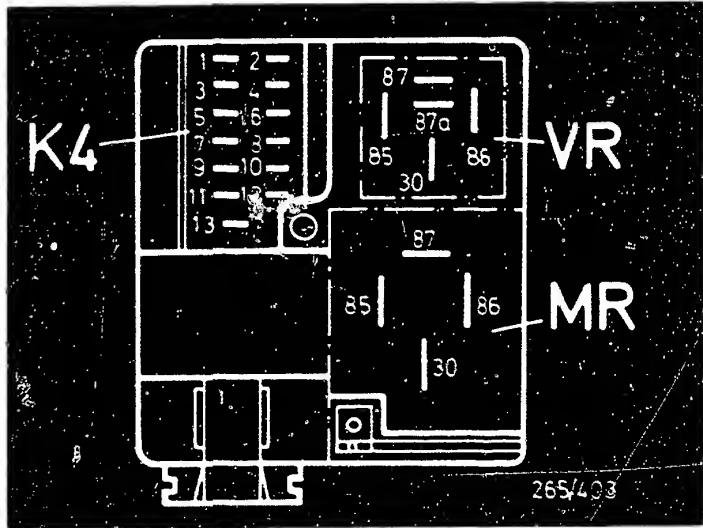
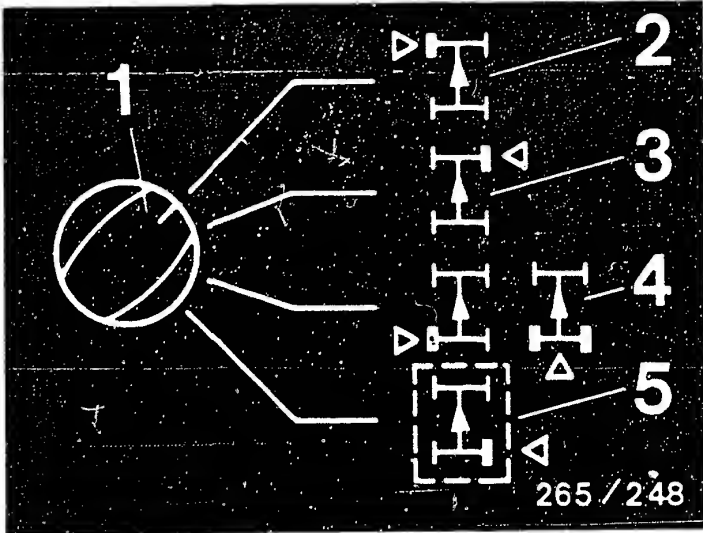
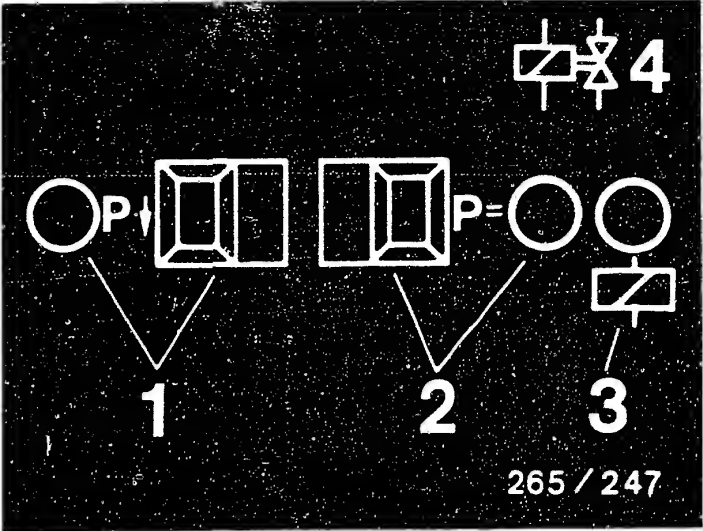


1 = Hydraulic modulator  
2 = Motor relay  
3 = Valve relay



RAPID DIAGNOSIS CHART (CONTINUED)  
Program-selector-switch position 5 (4-channel hydraulic modulator)

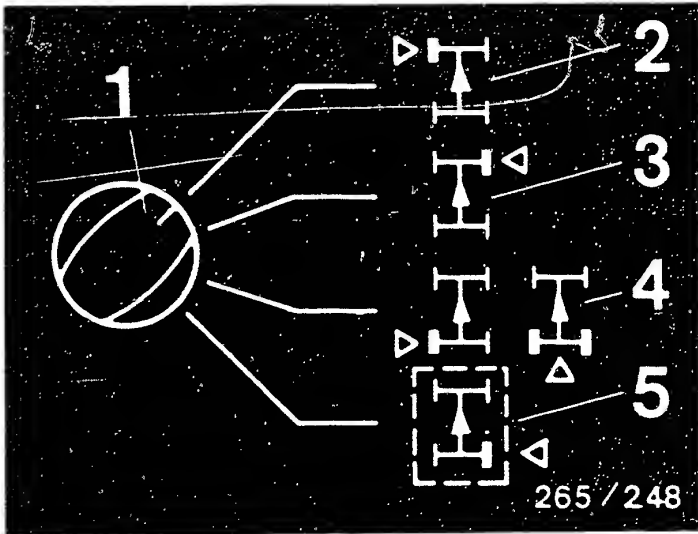
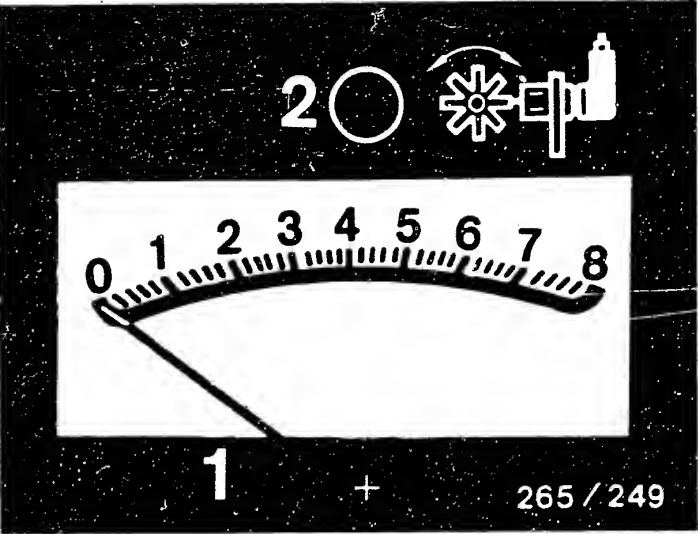
Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Valve relay operation (term. 27)	Ignition on	LED 3 (upper illustration) lights up	* Valve relay (winding) or leads defective
Solenoid-operated valves in hydraulic modulator for operation and and mix-up. NOTE: Check each wheel separately in turn. Keep to operating sequence.	Chock up vehicle. Ignition on. The wheel being tested must be freely turnable by hand. Set switch 1 for wheel selection to wheel to be tested (center illustration).		* Repeat test with engine running  * Valve relay (make contact) defective  * Break in lead from valve relay term. 87 to B+
Operation, pressure holding	1. Constantly press push-but. P = (upper illustration)	LED P= (upper illustration) lights up)	* Brake leads at hydraulic modulator mixed up  * Current value not obtained (LED P arrow or P= goes out; upper illustration); battery insufficiently charged. Repeat check with engine running.
	2. Constantly press brake pedal	Wheel turnable by hand	
	3. Release push-button P = (upper illustration)	LED P= goes out (upper illustration) Wheel locks	
Operation, pressure reduction	4. Press push-button P arrow (upper illustration)	LED P arrow (upper illustration) lights up, wheel turnable by hand	* Solenoid-operated valves correctly connected electrically? Wheel, front left: term.2 Wheel, front right: term.35 Wheel, rear left: term.18 Wheel, rear right: term.19 Rear axle: term. -  * Hydraulic modulator defective
	5. Release push-button P arrow (upper illustration)	LED P arrow (upper illustration) goes out, wheel locks	
	6. Release brake pedal		



RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 6 (4 wheel-speed sensors)

Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
<p>Wheel-speed sensor for operation and mix-up</p> <p>NOTE: Check each wheel separately in turn.</p> <p>(Wheel, front left: term.4 and term.5</p> <p>Wheel, front right: term.23 and term.21</p> <p>Wheel, rear left: term.7 and term.9</p> <p>Wheel, rear right: term.24 and term.26)</p>	<p>Chock-up vehicle. Ignition on.</p> <p>The wheel being tested must be freely turn- able by hand.</p> <p>When testing the driven axle, the wheel not being tested must be locked.</p> <p>Set switch for wheel selection to wheel to be tested (lower illustration)</p> <p>Turn wheel by hand until LED 2 above instrument lights up without flickering. (Wheel speed approx. 1 revolution per second). Afterwards, read off indication at instrument: (upper illustration)</p>	<p>1. Smallest reading larger 1,0 divisions</p> <p>2. Permissible fluctuation max. 25 % of largest reading.</p>	<p>*Wheel-speed-sensor lead mixed up</p> <p>*Brake in wheel-speed- sensor lead</p> <p>*Wheel-speed sensor defective</p> <p>Winding resistance Front axle: 0,6...1,6 k <math>\Omega</math></p> <p>Rear axle: 0,6...1,6 k <math>\Omega</math></p> <p>*Air gap between wheel- speed sensor and ring gear too wide</p> <p>*Ring gear defective or loose</p> <p>*Ring gear with incorrect number of teeth installed Front axle: 90 teeth Rear axle: 90 teeth</p> <p>*Wheel-bearing clearance too large</p> <p>*Instrument gives reading, LED 2 does not light up: loose contact in wheel- speed sensor lead.</p>



# TEST SPECIFICATIONS

## Wheel-speed sensor

- \* Winding resistance at ambient temperature (-10°C...+120°C) for

Front axle:	600...1600	Ω
Rear axle:	600...1600	Ω

## Hydraulic-modulator solenoid-operated valves

- \* Winding resistance at ambient temperature (-10°C...+120°C):

0,7...1,7 Ω

## Air gap:

0,8 ±0,5 mm

## Tightening torque for

- \* Fastening screws of wheel-speed sensors:

> 8 Nm

- \* Brake-line connections on hydraulic modulator:

12...16 Nm

## Number of teeth

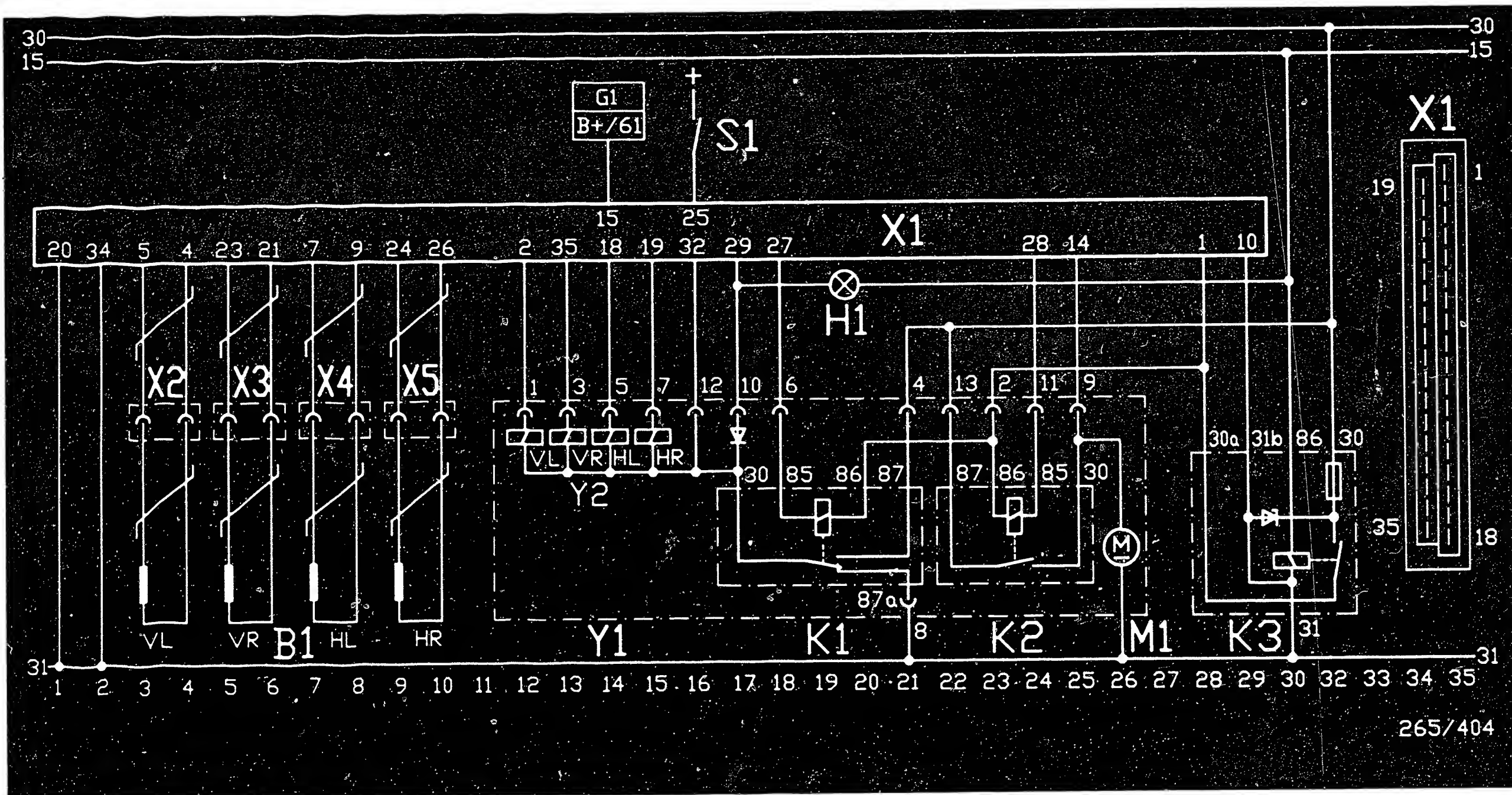
- \* Front axle:
- \* Rear axle:

90 teeth

90 teeth

For production reasons:  
continued on the following  
coordinate.





265/404

B1 = Wheel-speed sensor  
 G1 = To alternator  
 H1 = ABS warning lamp  
 K1 = Valve relay  
 K2 = Motor relay  
 K3 = Overvoltage-protection relay

M1 = Return-supply-pump motor  
 S1 = Stop-lamp switch  
 X1 = Controller plug (35-pin)  
 X2...X5 = Wheel-speed-sensor plug  
 Y1 = Hydraulic modulator  
 Y2 = Solenoid-operated valves

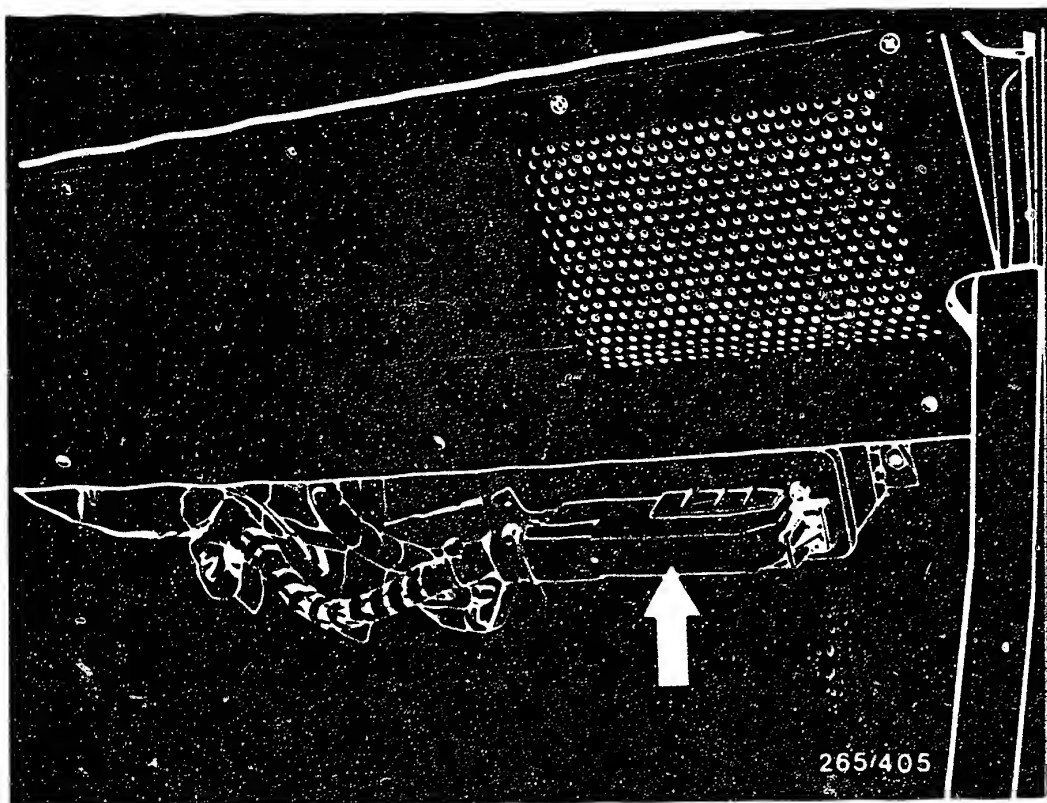
HL = Rear left  
 HR = Rear right  
 VL = Front left  
 VR = Front right

# ELECTRICAL TERMINAL DIAGRAM

D19

D20



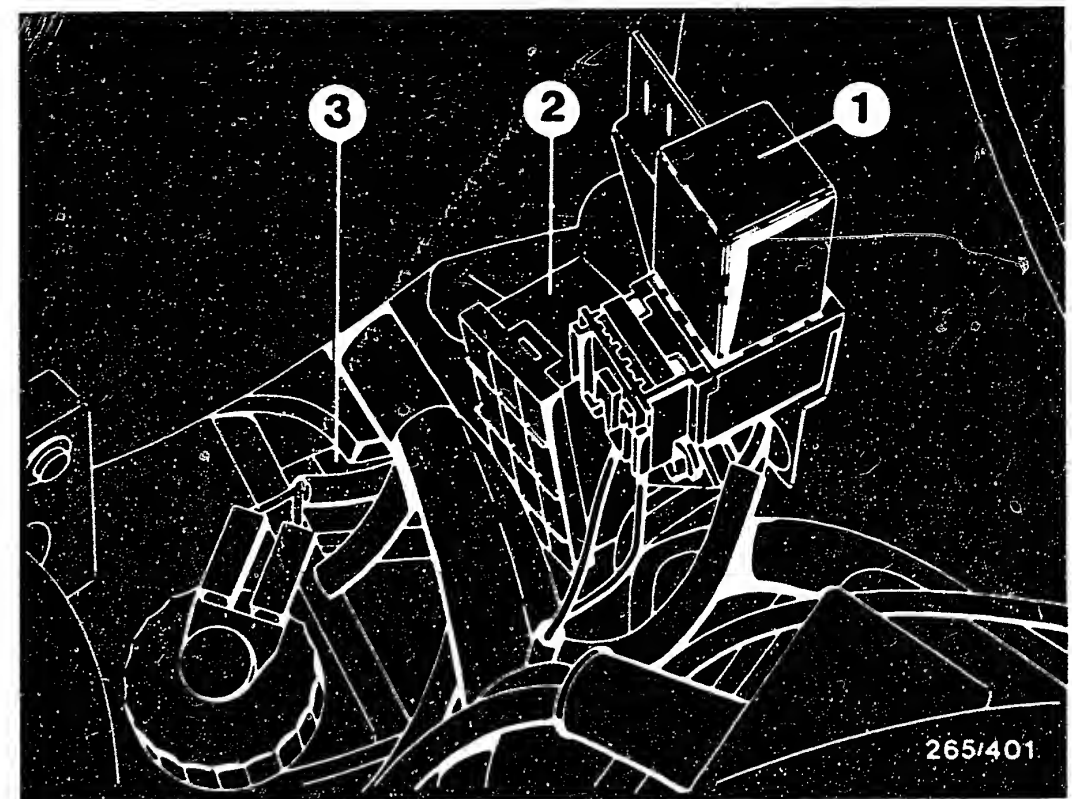


Arrow = ABS controller

#### INSTALLATION POSITION OF COMPONENTS

The indications "right" and "left" always refer to the forward direction of travel.

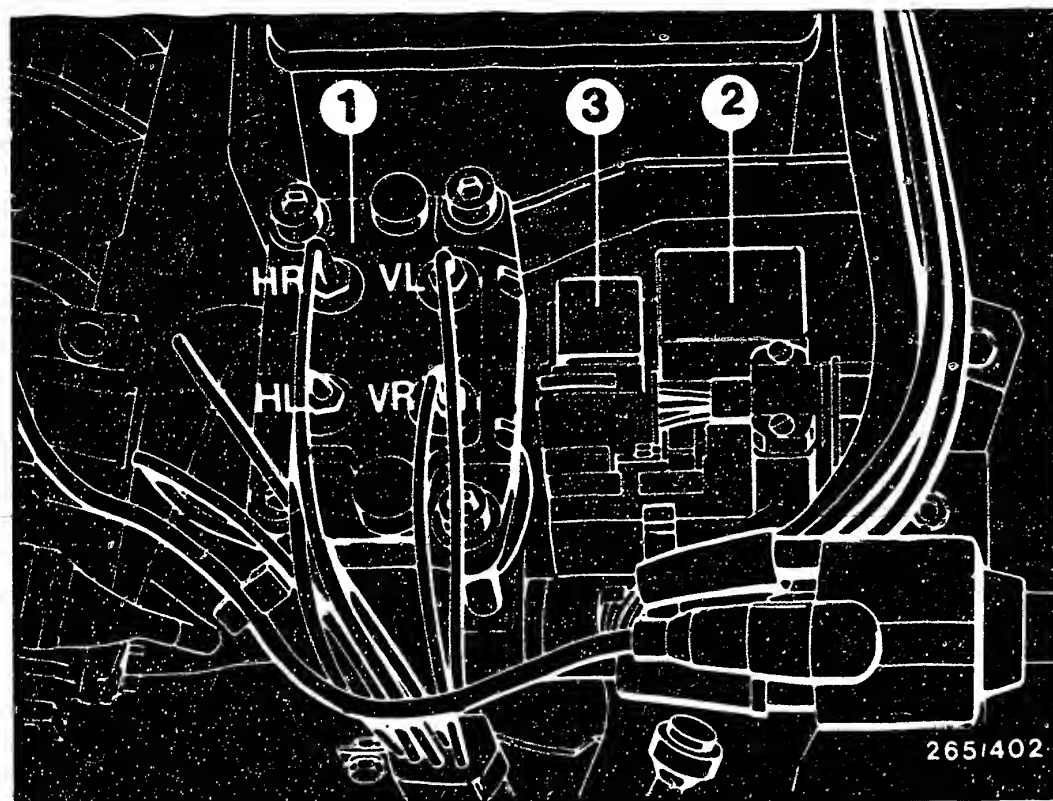
- \* Controller:  
in the passenger-side footwell beneath the glove compartment. Unscrew the lower panel.
- \* ABS warning lamp: in the instrument panel.  
Symbol: skidding car.
- \* Stop-lamp switch:  
on the brake pedal.



- 1 = Overvoltage-protection relay
- 2 = Socket with positive and ground terminals
- 3 = Wheel-speed-sensor plug-in connection

#### INSTALLATION POSITION OF COMPONENTS (Continued)

- \* Overvoltage-protection relay:  
in the engine compartment on the left-hand McPherson strut dome.
- \* Ground terminal:  
in the engine compartment on the left-hand McPherson strut dome beneath the overvoltage-protection relay.  
Ground terminal is located in a housing for positive and ground terminals.



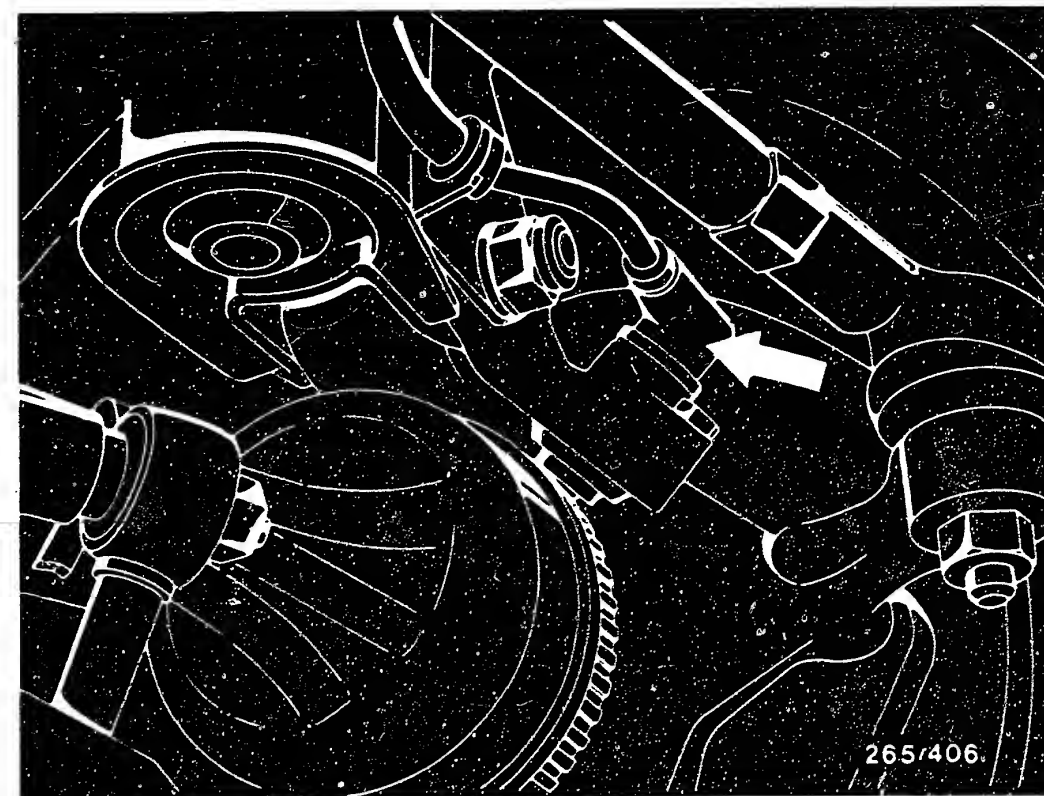
- 1 = Hydraulic modulator
- 2 = Motor relay
- 3 = Valve relay

#### INSTALLATION POSITION OF COMPONENTS (Continued)

- \* Hydraulic modulator:  
in the engine compartment at the front on the left-hand side in front of the battery.

The hydraulic modulator must not be repaired, but be exchanged only as a complete unit.  
Exception: relays may be exchanged.

Make sure that the brake-line connections are not mixed up.



Arrow = Wheel-speed sensor, front right

#### INSTALLATION POSITION OF COMPONENTS (Continued)

- \* Wheel-speed sensors, front axle:  
one on each side in the steering knuckles.  
If required, insert shims to give the correct air gap.

Wheel-speed-sensor plug-in connections:  
on the McPherson strut domes in the engine compartment.

- \* Wheel-speed sensors, rear axle:  
one on each side on the wheels.

Wheel-speed-sensor plug-in connections:  
on the left and right in the luggage compartment in the wheel houses under the side panelling.

Trouble-shooting instructions : BMW-5016  
BOSCH system : Motronic M 1.3  
Make of vehicle : BMW  
Basic microcard : PKW-052

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SPECIAL FEATURES

- These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:
- \*BMW 318i with and without catalytic converter as of 09.87  
Engine: 1.8 l / 4 cyl.
  - \*Motronic system M 1.3 with self-diagnosis and flashing-code output (55-pin plug).
  - \*The flashing-code fault output is initiated (stimulated) and continued by pressing the full-load switch 5 times (with the ignition switched on, apply full throttle 5 times within 5 seconds). Each flashing code is continuously output until the next flashing code is called up.  
The last code to appear is the flashing code 0 0 0 0 or 1 0 0 0 = End of output.  
The fault memory is cleared by closing the full-load switch for at least 10 sec. while the "end of output" flashing code is being output.  
End self-diagnosis: switch off ignition.
  - \*Control unit with variant encoding.  
Important information:  
See basic instructions for details which must be given when ordering control units.
  - \*Control unit with integral holding circuit (for tank-ventilation valve).
  - \*Adaptive low-idle-speed control with single-winding rotary actuator.
  - \*Group injection: division into 2 groups which inject with staggered timing (except in the warm-up phase and when accelerating).  
Synchronization by means of sensor on H.T. lead of cyl. 4).  
Group 1: cylinders 1,3  
Group 2: cylinders 2,4
  - \*Adaptive lambda closed-loop control and tank vent with pulsed valve (if cat).

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!  
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

\* Avoid injection of fuel and high-voltage flashovers when testing the compression.  
Therefore, disconnect main relay.

TROUBLE-SHOOTING CHART

Customer complaints (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/ top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

										Cause (component fault)
*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*										Voltage at control unit
*										Engine-speed/reference mark sensor
*		*			*	*				Fuel pressure
*		*				*	*			Solenoid-operated injection valves
		*	*		*					Throttle-valve switch
		*	*	*	*	*				Air-flow sensor
		*	*	*						Idle actuator
*	*	*	*							Air-intake system
		*								Idle speed, CO
*		*		*	*					Ignition coil
*		*	*	*	*					Primary signal
		*	*	*	*	*				Secondary pattern
*	*	*	*		*	*		*	*	Ignition point
*				*						High-voltage sensor
		*								Overrun cut-off
		*	*	*						Interference-suppression resistors
		*	*	*						Noise test
					*					Interference
					*					Throttle valve
					*					Fuel delivery
	*	*	*				*			Tank vent
		*	*							Lambda closed-loop control
*	*	*	*	*	*	*	*	*	*	Control unit

## SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
4 4 4 4 or 1 4 4 4	No fault stored			—
1 2 1 1	Control unit (memory contents)	Control unit defective.		—
1 2 1 5	Air-flow sensor	Check leads between air-flow sensor and control unit for open circuits and short circuit. Wiper voltage must increase on opening the air-flow sensor flap as far as it will go (switch on ignition):	7,12,26  7, 26	0.2...0.3 V up to at least 4.2 V
1 2 2 1	Lambda sensor	Lead or lambda sensor is open-circuited, or short-circuited to ground or batt. +ve. Watch for worn cable insulation! Sensor heater defective. Sensor clogged.	28	—
1 2 2 2	Lambda closed-loop control to rich or lean stop	Test CO content: Test induction system for leaks. Test fuel pressure: Injection valves defective.		0,2...1,2 % by vol. 2,8...3,2 bar
1 2 2 3	Coolant-temperature sensor	Check temperature sensor and lead for open circuit and short circuit to ground.  Temperature-sensor resistance:      at +15...+30°C ; at approx. +80°C ;	45	—  1450...3300 Ω 280... 360 Ω
1 2 2 4	Air-intake temperature sensor	Check temperature sensor and lead for open circuit and short circuit to ground.  Temperature-sensor resistance at +15°C...+30°C:	44	—  1450...3300 Ω

# SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
1 2 3 1	Continuous-voltage supply for control unit	Continuous-voltage supply too low: Test voltage drops at positive and ground terminals. Charge battery.  Voltage too high: Test alternator regulator.	18(+), 19(-)	Greater than 9 V  Less than 16 V
1 2 3 2	Throttle-valve switch/ idle contact	Fault: idle contact constantly closed.  Idle contact closed in inoperated position: Slightly actuate throttle valve:	52	0 $\Omega$ Infinity $\Omega$
1 2 3 3	Throttle-valve switch/ full-load contact	Fault: full-load contact constantly closed.  Full-load contact closed in full-throttle position: Ease off accelerator pedal slightly:	53	0 $\Omega$ Infinity $\Omega$
1 2 5 1	Injection valves 2+4 with injection output stage (control unit)	Fault: short circuit to ground, to batt. +ve, or open circuit of common positive or negative lead. Check lead and valves 2+4 for short circuit and open circuit; if O.K., control unit defective.	16	7...9 $\Omega$ (2 valves, parallel) 14...17 $\Omega$ (1 injection valve)
1 2 5 2	Injection valves 1+3 with injection output stage (control unit)	Fault: short circuit to ground, to batt. +ve, or open circuit in common positive or negative lead. Check lead and valves 1+3 for short circuit and open circuit; if O.K., control unit defective.	17	7...9 $\Omega$ (2 valves, parallel) 14...17 $\Omega$ (1 injection valve)
1 2 6 1	Fuel-pump relay with corresponding output stage in control unit	Fault 1*: short circuit to ground or open circuit. Fault 2 : short circuit to batt. +ve.  Disconnect pump relay and with ignition switched on, measure voltage (to ground) in frame (term. 86): Resistance of the relay coil (term. 85/86): Check lead to control unit (term. 3).	3	10... 15 V Approx. 50...150 $\Omega$

\* = Self-diagnosis detect faults only if further output stages are defective.



## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
1 2 6 2	Idle actuator with output stage (control unit)	Fault: short circuit to ground, to batt. +ve, or open circuit. Check supply leads and plug-in connection at actuator. Winding resistance at +15...+30°C:	4	Approx. 8 $\Omega$
1 2 6 3	Tank-ventilation valve with output stage (control unit) Note: cat models only	Fault: short circuit to ground or to batt. +ve. Check lead for contact with ground or batt. +ve; if O.K., control unit defective. Winding resistance at +15...+30°C :	5	35...55 $\Omega$
1 2 6 4	Sensor-heater relay with output stage (control unit)	Fault: short circuit to ground, to batt. +ve, or open circuit.  Disconnect pump relay and with ignition switched on, measure voltage (to ground) in frame (term. 86): Resistance of relay coil (term. 85/86): Check lead to control unit (term. 23).	23	10...15 V Approx. 50...150 $\Omega$
1 2 6 8	Idle potentiometer for CO adjustment	Fault: wiper voltage too low (less than 0,8 V) or too high (greater than 4,5 V). Check potentiometer setting (and CO). To do this, measure voltage at air-flow sensor term. 1 with ignition switched on: if test specification not obtained, test potentiometer and corresponding leads in accordance with circuit diagram.	43	0,8...4,5 V
1 2 7 8 *	Transmission action (intervention)	Fault: short circuit to ground. Check lead for open circuit to ground/ corresponding output in transmission control unit defective.	51	—
1 2 8 8	Fault lamp with lamp output stage (control unit)	Fault: short circuit to ground or to batt. +ve.	15	—

\* = Applies to motor vehicles with electronic transmission control (ETC); in vehicles without ETC, term. 51 must be open.



## TEST SPECIFICATIONS

Pressure regulator	
Fuel pressure	2,8...3,2 bar
Electric fuel pump (measured in return)	Fuel delivery at least 650 cm <sup>3</sup> /30s
Supply voltage (under load):	at least 12 V

Intake-air temperature sensor  
Internal electrical resistance  
measured at air-flow sensor  
between term.5 and term.4

at ambient temperature  
(+15°C...+30°C): 1450...3300 Ω

Coolant-temperature sensor  
(plug color, blue)  
Internal electrical resistance

at +15°C...+30°C: 1450...3300 Ω  
with engine at norm. op. temp.  
(approx. +80°C): 280...360 Ω

Solenoid-operated injection valve  
Internal electrical resistance  
at ambient temperature  
(+15°C...+30°C): 14,5...17 Ω

Air-flow sensor  
Internal electrical resistance between:  
term.2 and term.4: 8...2500 Ω (\*)  
term.3 and term.4: 300...550 Ω  
term.1 and term.4 (CO potentiometer):  
Minimum 0...30 Ω  
Maximum: the actual value measured  
between term. 3 and term. 4 may be  
up to 30 Ohms less.

(\*) Slowly deflect air-flow sensor flap as far as  
it will go. Resistance fluctuates between the  
terminals of the potentiometer.

## TEST SPECIFICATIONS (CONTINUED)

Engine-speed/reference-mark sensor  
Internal electrical resistance  
between term.1 and term.2 at ambient  
temperature (+15°C...+30°C): 400...800 Ω  
Air gap: 0,8 ± 0,5 mm

Throttle-valve switch  
Resistance value of idle  
contact (term.2 and term.18): 0 Ω  
Resistance value of full-load  
contact (term.3 and term.18): 0 Ω

Idle actuator  
Internal electrical resistance  
at +15°C...+30°C: Approx. 8 Ω

Lambda sensor  
Resistance value of heater winding  
(sockets 3 and 4 in the 4-pin  
terminal to lambda sensor): 1...15 Ω

Ignition coil  
Primary resistance: Approx. 0,8 Ω  
Secondary resistance: 5000...7200 Ω

Interference-suppression resistors  
High-voltage-distributor rotor: 1 k Ω  
High-voltage-distributor dome: each 1 k Ω  
Spark-plug connectors: each 5 k Ω  
Spark plugs: 5 k Ω  
Ignition coil: 1 k Ω

## TEST SPECIFICATIONS (CONTINUED)

---

### High-voltage sensor:

Internal electrical resistance  
between term.1 and term. 2:

Approx. 0  $\Omega$

---

### Tank-ventilation valve:

(in catalytic-converter vehicles only)

Internal electrical resistance at  
ambient temperature

(+15°C...+30°C): 35...55  $\Omega$

---

### Idle test:

Engine at normal operating temperature,  
switch off loads.

Idle speed: 800  $\pm$  40 min<sup>-1</sup>

Spark-advance angle: 12  $\pm$  5° crankshaft

(Automatic transmission to N or P)

---

### CO content: without

catalytic converter: 0,5...1,5 % CO by vol.

Adjust mixture by means of CO  
potentiometer in air-flow  
sensor:

turning to the left makes mixture leaner,

turning to the right makes mixture richer.

Max. adjustment of duration  
of injection:

Approx. 0,6 ms

---

### Catalytic-converter

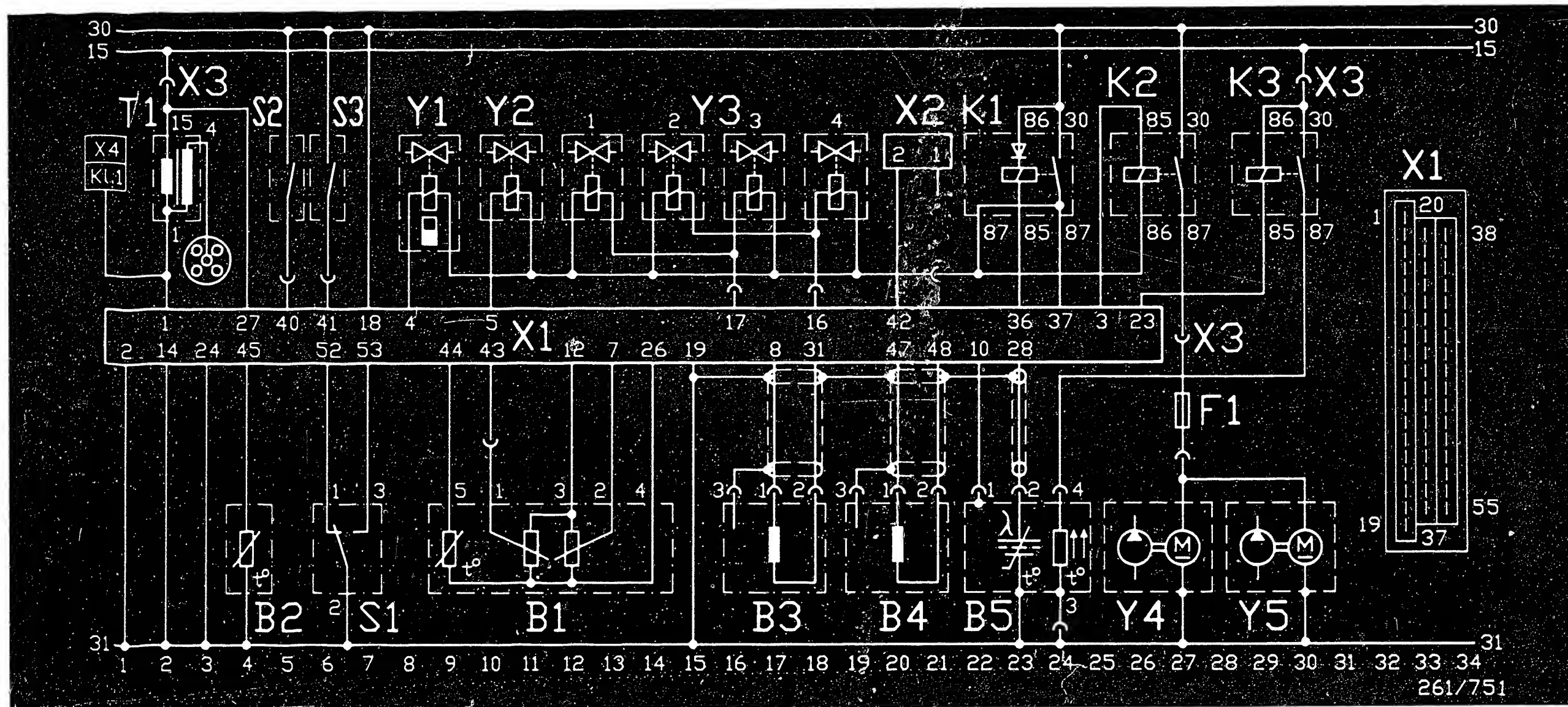
vehicles: 0,2...1,2 % CO by vol.

(measure CO upstream of the catalytic  
converter if sample pickup fitted,  
pull apart lambda-sensor plug).

---

See equipment and Autodata microcards for  
the settings for valve clearance and other  
engine-related data.

For production reasons:  
continued on the following  
coordinate.

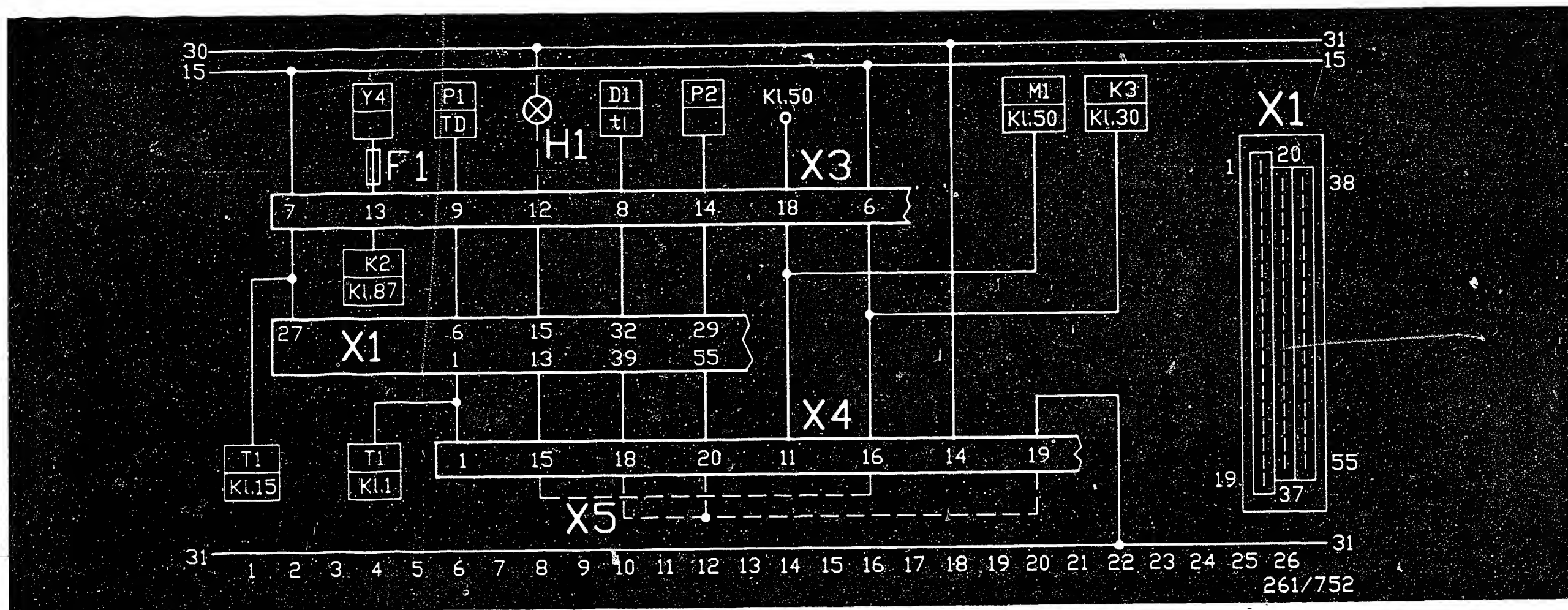


B1 = Air-flow sensor  
 B2 = Coolant-temperature sensor  
 B3 = High-voltage sensor  
 B4 = Engine-speed/reference-mark sensor  
 B5 = Heated lambda sensor (cat)  
 F1 = Pump fuse (No. 11)  
 K1 = Main relay  
 K2 = Pump relay  
 K3 = Sensor-heater relay (cat)

S1 = Throttle-valve switch  
 S2 = Switch on air-conditioner compressor  
 S3 = Switch on air conditioner  
 T1 = Ignition coil  
 X1 = Motronic control-unit plug  
 X2 = Plug-in connection to automatic transmission (P/N switch)  
 X3 = Engine plug  
 X4 = Diagnostic socket

Y1 = Idle actuator  
 Y2 = Tank-ventilation valve (cat)  
 Y3 = Solenoid-operated injection valve  
 Y4 = Electric fuel pump  
 Y5 = Pre-supply pump (if fitted)

ELECTRICAL TERMINAL DIAGRAM

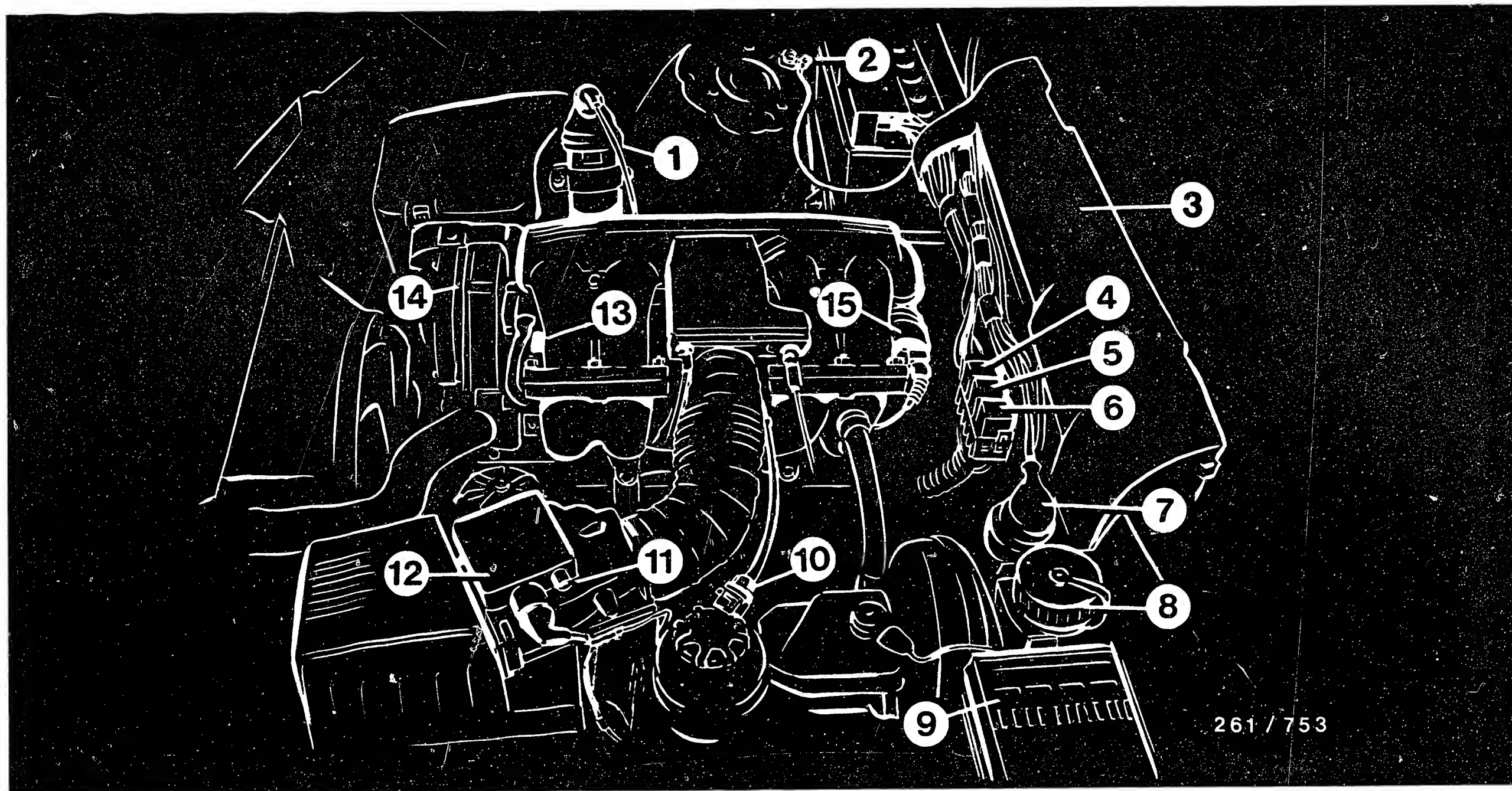


D1 = On-board computer  
 F1 = Pump fuse (No. 11)  
 H1 = Fault lamp; also for flashing  
 code output (presently in  
 US modes only).  
 K2 = Pump relay

K3 = Sensor-heater relay (cat)  
 M1 = Starting motor  
 P1 = Tachometer  
 P2 = Speedometer  
 T1 = Ignition coil  
 X1 = Motronic control-unit plug

X3 = Engine plug  
 X4 = Diagnostic socket  
 X5 = Bridge in cover  
 Y4 = Electric fuel  
 pump

ELECTRICAL TERMINAL DIAGRAM (Continued - diagnostic and engine plugs)



261 / 753

- 1 = Ignition coil
- 2 = Motronic ground terminal
- 3 = Cover over relay
- 4 = Main relay (white)
- 5 = Pump relay (orange)
- 6 = Sensor-heater relay (orange)
- 7 = Engine plug

- 8 = Diagnostic socket
- 9 = Fuse box
- 10 = Tank-ventilation valve
- 11 = CO potentiometer
- 12 = Air-flow sensor
- 13 = Fuel-pressure regulator
- 14 = High-voltage distributor
- 15 = Idle actuator

# INSTALLATION POSITION OF COMPONENTS



## INSTALLATION POSITION OF COMPONENTS (Continued)

The indications "right" and "left" always refer to the forward direction of travel.

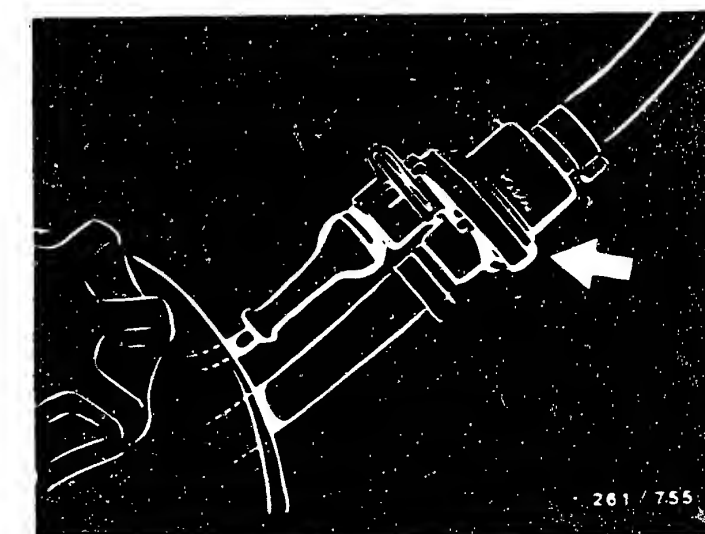
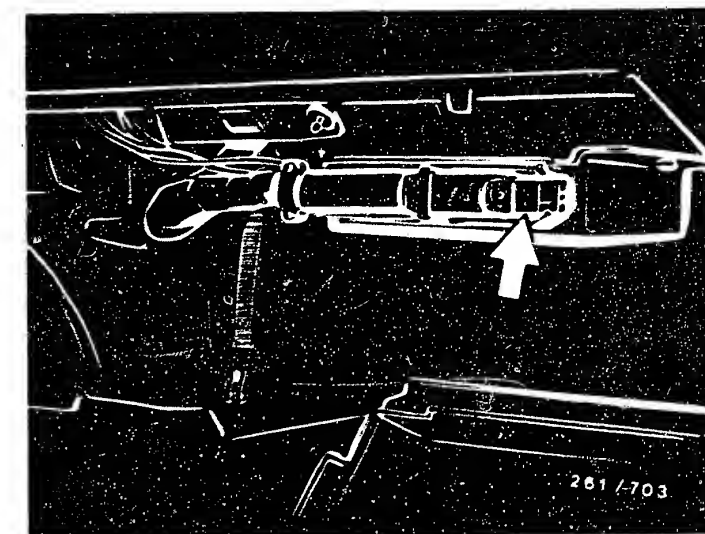
Control unit:  
in the glove compartment above the cover (upper illustration, arrow).

Lambda sensor (Cat):  
in the common exhaust pipe (center illustration, Item. 1).

Plug-in connection to lambda sensor (round, 4-pin):  
near to battery (center illustration, Item 2).

Tank-ventilation valve (Cat):  
see lower illustration, arrow.

Activated-carbon canister (Cat):  
in the engine compartment on the left-hand side next to the fuel filter.



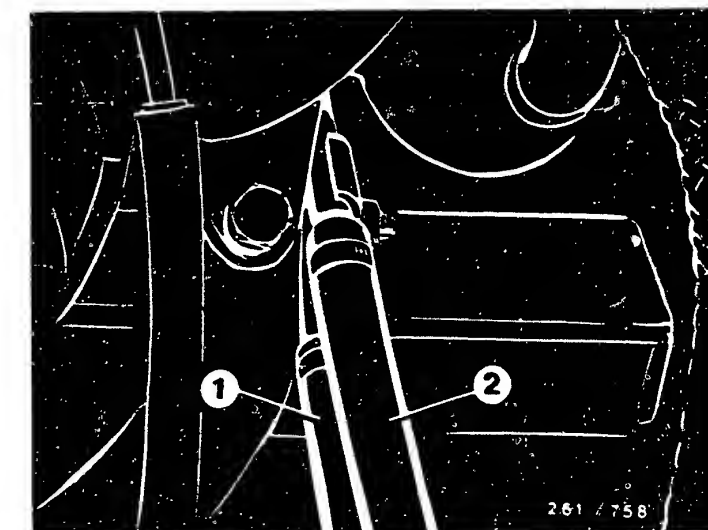
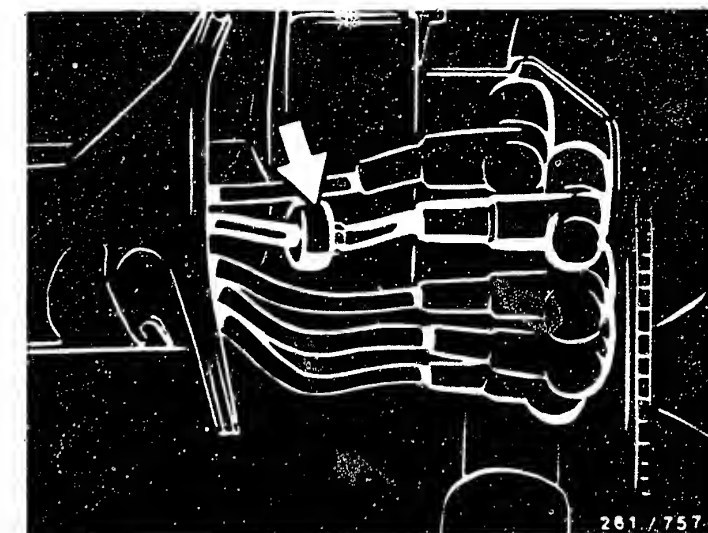
## INSTALLATION POSITION OF COMPONENTS (Continued)

Engine-speed/reference-mark sensor:  
on the engine at the front to the right of the crankshaft ring gear (upper illustration, arrow)

High-voltage sensor:  
on the H.T. lead to cylinder 4 (center illustration, arrow).

Connection point for fuel-pressure measurement:  
on the fuel-inlet hose (near to oil dipstick); see lower illustration,  
Item 1 (Item 2: fuel-return line).

Air-temperature sensor:  
in the air-flow sensor.





## INSTALLATION POSITION OF COMPONENTS (Continued)

Electric fuel pump:  
beneath the vehicle (upper illustration, Item 1)  
or in the tank (if in-tank fuel pump).

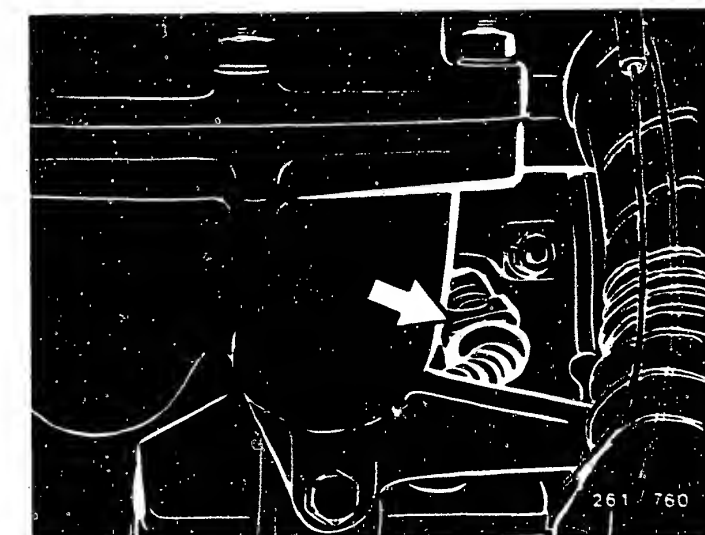
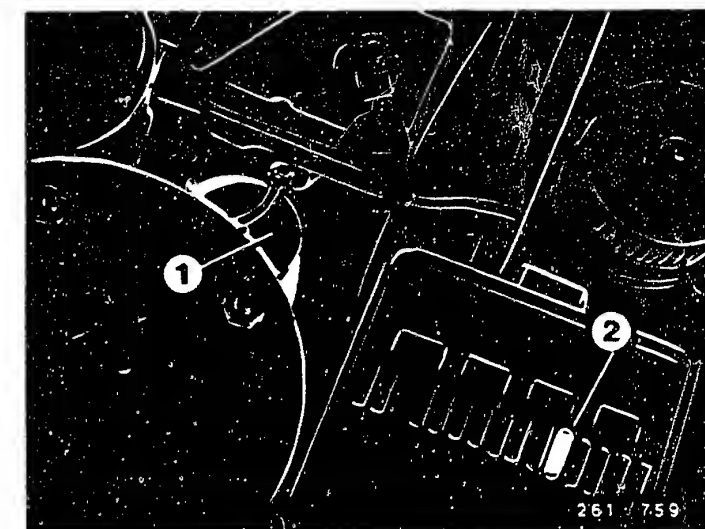
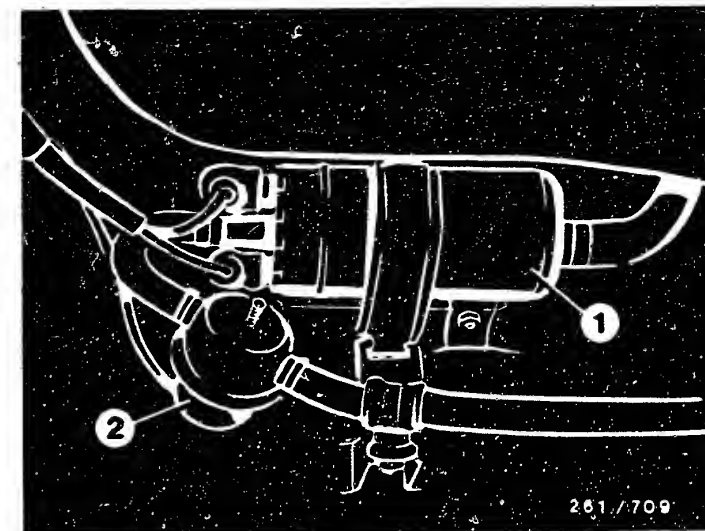
Fuse No. 11 for electric fuel pump:  
in the fuse box on the firewall on the left (center illustration, Item 2).

Fuel-pressure damper:  
beneath the vehicle (upper illustration, Item 2).

Fuel filter:  
in the engine compartment on the left-hand side, near to the firewall (center illustration, Item 1).

Coolant-temperature sensor:  
screwed into the engine block (lower illustration, arrow).

Throttle-valve switch:  
at the bottom of the throttle-valve assembly.



Trouble-shooting instructions : AUD-5010  
BOSCH system : KE-Jetronic -3.3  
Make of vehicle : AUDI  
Basic microcard : PKW-065

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## SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following AUDI models:

AUDI 100, 100 Quattro, Gen., USA  
AUDI 5000 California  
Engine NF / 2.3 l / 5 cylinders 06.87->

AUDI 90, 90 Quattro, Gen.  
Engine NG / 2.3 l / 5 cylinders 08.87->

- \* KE-Jetronic system version 3.3 with self-diagnosis and flashing-code output
- \* Final-controlling-element diagnosis
- \* Tank vent with pulsed valve
- \* Lambda closed-loop control
- \* In-tank electric fuel pump in AUDI 100
- \* Electronic ignition with knock control, self-diagnosis, and flashing-code output

Special information with regard to the self-diagnosis system of the KE 3.3-Jetronic:

In contrast to the version described in the basic instructions, the self-diagnosis system is equipped with a permanent memory, i.e. faults remain stored even after the ignition is switched off. The fault memory can be cleared only after the self-diagnosis and final-controlling-element diagnosis has been called up.

The following test sequence must be observed:

## SPECIAL FEATURES (Continued)

Call up self-diagnosis in the input mode. If the fault memory has been cleared, take the vehicle for a test run on the road or roller-type test stand for at least 5 minutes. During this test run, accelerate engine at least once to a speed greater than  $3000 \text{ min}^{-1}$ , in the process, briefly depressing the accelerator pedal to the floor. Or, if the engine will not start, activate the starting motor for at least 6 seconds. Call up self-diagnosis with the engine not running or running at idle speed.

### Activating ignition system EI-K:

Ignition ON. Bridge contact at fuel-pump relay for at least 4 seconds with fuse. Make a note of flashing code. Continue bridging contact until flashing code 0 0 0 0 (end of fault output) appears. Evaluate flashing code, see EI-K SIS.

### Activating KE-Jetronic:

Possible only after "End" of EI-K fault output. Bridge contact for at least 4 seconds. Engine speed is automatically increased to approx.  $1200 \text{ min}^{-1}$ . Evaluate flashing code - see self-diagnosis test table. Continue until flashing code 0 0 0 0 ("End" of fault output) appears.

### Activating final-controlling-element diagnosis:

Ignition OFF. Bridge contact. After approx. 4 seconds, ignition ON. After a further 4 seconds, disconnect the bridge. Flashing code indicates which final controlling element is energized. Continue until flashing code 0 0 0 0 ("End" of fault output) appears. Afterwards, do not switch off ignition, so that fault memory can be cleared.

### Clearing fault memory:

Bridge contact for at least 4 seconds.  
Fault memory is cleared.  
Fault lamp is OFF.

## STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, trigger boxes and control units, or to the ignition system, be sure to observe the information in the basic instructions.

### ATTENTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

When testing the compression, disconnect the pump relay in order to prevent unwanted injection of fuel by the injection valves.

While the tests are in progress with the electric fuel pump running, never deflect (lift) the air-flow sensor plate, because this causes the injection valves to inject fuel. This may lead to severe damage to the engine when the engine is subsequently started.

## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts, but dies again.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*	*	*	*	*	*	*	*	*	*	Pressure actuator
		*								Tank-vent valve
		*								Idle actuator
*		*			*					Cold-start valve
*		*	*	*	*					Intake system
*	*	*	*	*	*	*				Air-flow sensor
*					*					Air-flow sensor plate
*	*			*	*					Electric fuel pump
*	*			*	*					Primary pressure
*	*	*	*	*	*	*				Differential pressure
*										Fuel system leaking
*	*	*	*	*	*	*				Injection valves
*	*	*	*	*	*	*				Fuel distributor

## TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts, but dies again.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
*	*	*	*	*	*	*	*	*	*	Throttle valve
*	*	*	*	*	*	*	*	*	*	Voltage supply, control unit
*	*	*	*	*	*	*	*	*	*	Temperature sensor (coolant)
		*	*							Throttle-valve switch, idle
				*		*	*			Throttle-valve switch, full load
		*	*	*	*	*	*	*	*	Lambda closed-loop control
*	*	*	*	*	*	*	*	*	*	Exhaust-gas adjustment
		*								Low-idle-speed control
*										Starting enrichment
	*									Post-starting enrichment
	*	*	*							Warm-up enrichment
		*								Acceleration enrichment
		*	*							Full-load enrichment
				*						Overrun cut-off

## SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/ Test conditions	Termi- nals	Set values
1 1 1 1	Control units	Make sure whether fault-code output applies to EI-K or KE! EI-K control unit or KE control unit defective.		
2 1 2 1	Idle throttle-valve switch or lead defective	Watch out whether fault-code output applies to EI-K or KE! Idle throttle-valve switch constantly closed. Lead to terminal 28 is short-circuited to positive. Setting incorrect. Throttle valve closed: Throttle valve open: Check setting:	KE 28 EI-K 7	0 $\Omega$ infinity $\Omega$ 0.6 mm
2 1 2 2	No engine-speed signal from ignition system	Open circuit in lead from KE control unit terminal 30 to EI-K control unit terminal 17. Check lead for continuity: Check ignition system: See SIS Overview (KFZ-00..)	KE 30 EI-K 17	0 $\Omega$
2 1 2 3	Full-load throttle-valve switch or lead defective	Watch out whether fault-code output applies to EI-K or KE! Full-load throttle-valve switch constantly closed. Lead to terminal 28 is short-circuited to positive. Setting incorrect. Throttle valve closed: Throttle valve open: Check setting:	KE 31 EI-K 9	infinity $\Omega$ 0 $\Omega$ 68...76°
2 1 4 1	Knock control at control stop	Test ignition system: See SIS Overview (KFZ-00..)		
2 1 4 2	Knock sensor or lead defective	Test ignition system: See SIS Overview (KFZ-00..)		

## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions/ Test conditions	Termi- nals	Set values
2 2 2 3	Altitude sensor or lead defective	Note whether fault-code output concerns EI-K or KE! Test altitude-sensor voltage supply at terminals 2 and 3. Test voltage signal at terminals 1 and 3. Open-circuit in lead. Test lead continuity:	KE 25, 26,35  EI-K 2	4.35...5.35 V See test specifications  0 $\Omega$
2 2 3 2	Potentiometer at air-flow sensor or lead defective	Test potentiometer voltage supply at terminals 1 and 3. Test voltage signal at terminals 1 and 2.  Open-circuit in lead. Test lead continuity:	KE 23, 26,35	4.35...5.35 V Voltage increase, max. 5.35 V  0 $\Omega$
2 2 3 3	Reference voltage for load and altitude signal for EI-K control unit	Open-circuit in lead from KE control unit, terminal 26 to EI-K control unit, terminal 21. Test lead continuity:	KE 26 EI-K 21	0 $\Omega$
2 3 1 2	Temperature sensor (engine) or lead defective (twin NTC, one connection for KE-Jetronic)	Note whether fault-code output concerns EI-K or KE! Open-circuit or short-circuit to ground in lead from KE-control unit, terminal 3 to temperature sensor (engine). Test lead continuity:  Test short-circuit of leads to ground:  Temperature-sensor (engine) resistance  * Cold engine (+15°C...+30°C)  * Engine at operating temperature (approx. 80°C)	KE 3	0 $\Omega$  Infinity $\Omega$  1300...3600 $\Omega$  250... 390 $\Omega$

## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions/ Test conditions	Termi- nals	Set values
2 3 4 1	Lambda closed-loop control outside working range (control limits exceeded or dropped below)	<p>Fault occurs only in idle/part-load range. Fault detection at the earliest 6 minutes after starting.</p> <p>Possible causes of fault:</p> <ul style="list-style-type: none"> <li>* Lambda closed-loop control not functioning or functioning incorrectly, short-circuit in sensor lead, defective lambda-sensor heater.</li> <li>* Start valve leaking.</li> <li>* Induction system leaking (leakage air).</li> <li>* Tank-ventilation valve permanently open.</li> <li>* Incorrect idle setting.</li> </ul>	— —	— —
2 3 4 2	Lambda sensor or lead defective	<p>Lead from KE-control unit, term. 7 to lambda sensor: open-circuit, short-circuit to ground or battery voltage</p> <p>Test lead continuity: test short-circuit of leads to ground and battery voltage: Note any abrasion! Sensor heater defective. Resistance, sensor blocked off:</p>	KE 7	<p>0 <math>\Omega</math></p> <p>Infinity <math>\Omega</math></p> <p>1...15 <math>\Omega</math></p>
4 3 4 1	Pressure actuator or lead defective	<p>Test resistance of pressure actuator: Test lead continuity:</p>	KE 4,5	<p>16...22 <math>\Omega</math></p> <p>0 <math>\Omega</math></p>
4 3 4 3	Tank-ventilation valve or lead defective	<p>Open-circuit or short-circuit to ground in lead from KE-control unit, term. 15 to tank-ventilation valve.</p> <p>Test voltage supply (ignition, term. 15) to tank-ventilation valve: Test lead continuity: Test short-circuit of leads to ground:</p>	KE 15	<p>Battery voltage</p> <p>0 <math>\Omega</math></p> <p>Infinity <math>\Omega</math></p>



## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

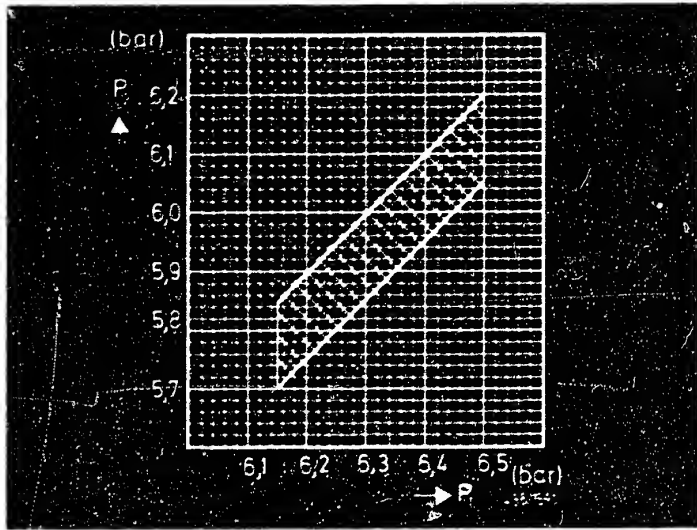
Fault indication Flashing code	Testing of component/function	Test instructions/ Test conditions	Termi- nals	Set values
4 4 3 1	Idle actuator or lead defective	Open-circuit or short-circuit to ground in lead from KE-control unit, term. 17 to idle actuator.  Open-circuit in voltage supply (ignition, term. 15) to idle actuator.  Test lead continuity:  Test short-circuit of leads to ground:	KE 17	Battery voltage  0 $\Omega$  Infinity $\Omega$
4 4 4 3	Start valve or lead defective	Open-circuit or short-circuit to ground in lead from KE-control unit, term. 16 to start valve.  Open-circuit in voltage supply (ignition, terminal 15) to start valve.  Test lead continuity:  Test short-circuit of leads to ground:	KE 16	Battery voltage  0 $\Omega$  Infinity $\Omega$
4 4 4 4	No fault			
0 0 0 0	End of fault output			

## TEST SPECIFICATIONS

No.	Testing/Test conditions	Set value
1	Engine-speed signal from EI-K control unit to KE control unit:	approx. 5,0 V
2	Supply voltage for altitude sensor:  Voltage signal from altitude sensor: Sea level 500 m 1000 m 1500 m 2000 m 3000 m	4,35...5,35 V  3,2...4,7 V 2,8...4,0 V 2,4...3,5 V 2,0...3,0 V 1,5...2,5 V 0,8...1,6 V
3	Supply voltage for potentiometer on air-flow sensor:  Voltage signal from potentiometer: air-flow sensor plate in neutral position air-flow sensor plate deflected	4,35...5,35 V  5,35 V max. 21 V
4	Resistance value, temperature sensor (coolant): engine cold (+15°C...+30°C) Engine at normal operating temperature (approx. 80°C)	1300...3600 Ω 250... 390 Ω
5	Lambda closed-loop control: open-loop control operation  closed-loop control operation  rich stop lean stop	-1...+1 mA (static) -1...+1 mA (pulsating) max. + 10 mA max. - 10 mA
6	Resistance value, pressure actuator:	16...22 Ω
7	Resistance value, tank-vent valve:	35...55 Ω
8	Resistance value, idle actuator:	4...12 Ω
9	Resistance value, cold-start valve:	6...14 Ω

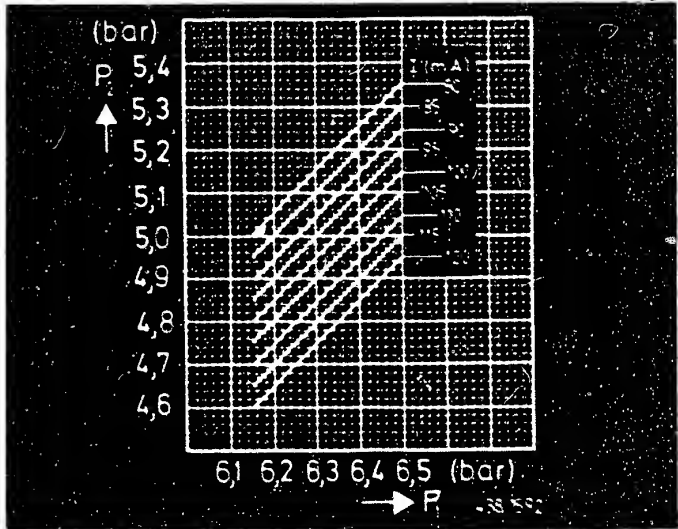
TEST SPECIFICATIONS (CONTINUED)

No.	Test/Test conditions	Set value	
10	Air-flow sensor plate position (zero position) beneath basic setting:	1,9...3,0 mm	
11	Air-flow sensor plate idle motion:	0,1...2,0 mm	
12	Electric fuel pump - delivery: Supply voltage (under load):	min. 1160 cm <sup>3</sup> /min min. 11,5 V	
13	Fuel distributor - primary pressure:	6,15...6,5 bar	
14	Differential pressure  Take lower-chamber-pressure set value "warm" corresponding to measured primary pressure from top graph. (Actuator current = 0 mA)  Take lower-chamber-pressure set value "cold" corresponding to measured primary pressure and actuator current from lower graph. Simulation of "cold" condition: switch on ignition (no-load current approx. 100 mA).		
15	Leak test for overall system:  Minimum pressure after 10 min.: Minimum pressure after 20 min.:	3,3 bar 3,2 bar	
16	Opening pressure of injection valves:	3,7...4,8 bar	
17	Fuel-delivery comparative measurement: Actuator current: 0 A  Idle: Part load: Full load:  Minimum quantity with max. air-flow sensor plate deflection:	Setting: (cm <sup>3</sup> /min)	Max. perm. quantity: (cm <sup>3</sup> /min)
		6,0 40,0 100,0	6,6 42,5 109,0
		125,0 cm <sup>3</sup> /min	



P 1 = Primary pressure  
P 2 = Lower-chamber pressure  
I = Actuator current

p 1 = Primary pressure  
p 2 = Lower-chamber pressure  
I = Actuator



## TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Set value
18	Rate of flow, KE restriction	130...150 cm <sup>3</sup> /min
19	Control-unit functions:  Starting enrichment (corresp. to 20°C)  Post-start enrichment (corresp. to 20°C)  Warm-up enrichment 1) (corresp. to 20°C)  Acceleration enrichment * Slowly increase speed  Full-load enrichment (corresp. to engine at normal operating temperature) Overrun cut-off (corresp. to engine at normal operating temperature)	  30...50 mA  20...30 mA  10...20 mA  Current value rises  4...10 mA  -40...-60 mA
20	CO-content adjustment 2)  Idle speed:  CO-content: * Lambda sensor disconnected Test value Setting  * Lambda sensor connected Pressure-actuator current	  670...770 min <sup>-1</sup>    0,3...3,0 % by vol. 0,6...1,0 % by vol.  0,3...2,2 % by vol. -1...+1 mA

1) Keep measuring time short in order to prevent over-enrichment and thus damage to the catalytic converter.

2) Notes on CO-content adjustment:

The idle speed cannot be adjusted.

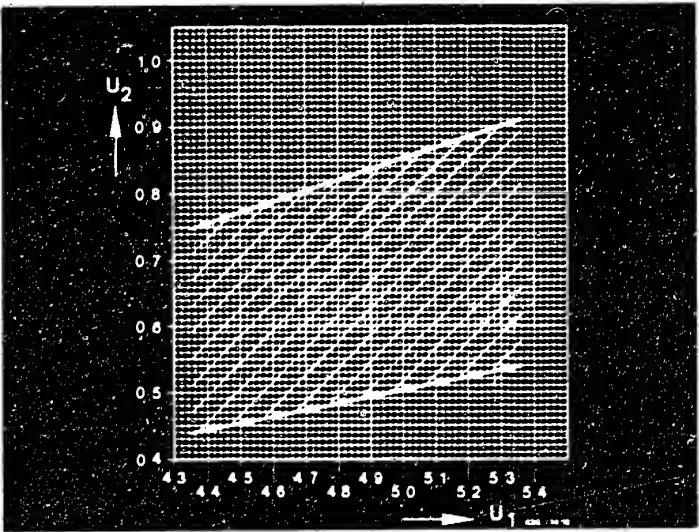
Engine-oil temperature at least 80 °C.

The crankshaft-breather hose must be disconnected and sealed off tightly.

Disconnect hose line to the activated-carbon filter from the air scoop (bracket remains open in the scoop).

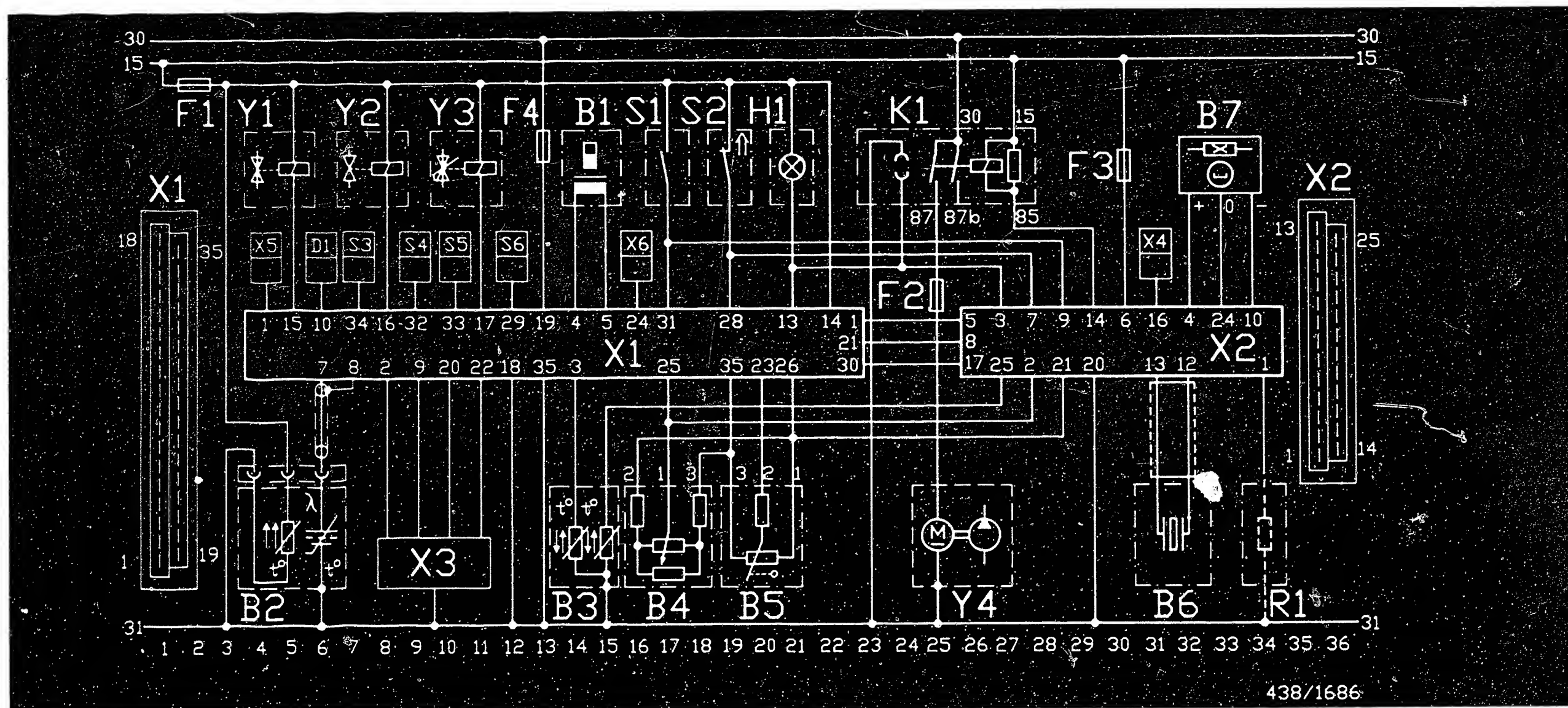
TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test conditions	Set value
21	<p>Signal, air-flow sensor potentiometer (measurement necessary only when idling and part-load behavior are poor).</p> <p>* Measure supply voltage at potentiometer terminals 1(+) and 3(-) and not down:</p> <p>* Measure voltage signal of potentiometer terminals 2(+) and 3(-) with engine at normal operating temperature and at idle speed and compare with set value from chart opposite.</p>	<p>4,35...5,35 V</p> <p>see chart</p>



U 1 = Supply voltage,  
potentiometer

U 2 = Potentiometer  
voltage signal



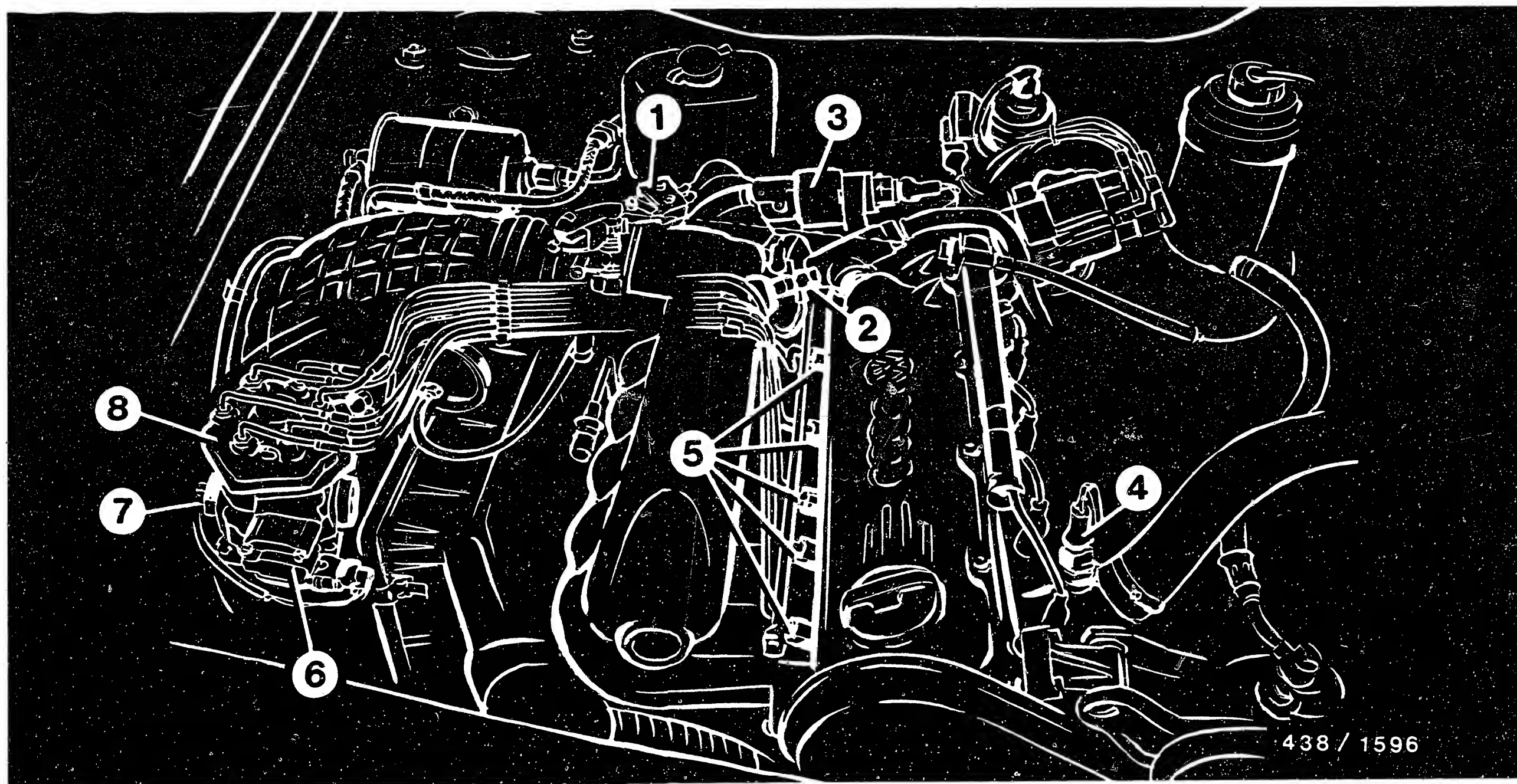
- |                                    |  |  |
|------------------------------------|--|--|
| B1 = Pressure actuator             | F4 = Fuse 19 (10 A)  | S6 = Connection, overrun-cutoff suppr. |
| B2 = Lambda sensor                 | H1 = Diagnostic lamp   | X1 = Plug, KE control unit             |
| B3 = Temperature sensor (engine)   | K1 = Electric-fuel-pump relay with contacts for triggering diagnosis                   | X2 = Plug, EI-K control unit           |
| B4 = Altitude sensor               | R1 = Resistor, variant encoding  | X3 = Plug, parameter encoding          |
| B5 = Air-flow-sensor potentiometer | S1 = Throttle-valve switch (full load)   | X4 = Plug, ignition trigger box        |
| B6 = Knock sensor                  | S2 = Throttle-valve switch (idle)  | X5 = Connection, diagnostic interface  |
| B7 = Hall generator                | S3 = Connection, transmission switch (In vehicles with man.-shifted transm. to ground) | X6 = Connection, idle encoding         |
| D1 = Connection, on-board computer | S4 = Connection, air conditioner (readiness)   | Y1 = Tank-ventilation valve            |
| F1 = Fuse 28 (15 A)                | S5 = Connection, air conditioner (compressor)  | Y2 = Cold-start valve                  |
| F2 = Fuse 13 (15 A)                |  | Y3 = Idle actuator                     |
| F3 = Fuse 24 (10 A)                |  | Y4 = Electric fuel pump                |

ELECTRICAL TERMINAL DIAGRAM

F23 —————>

F24 <—————





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- 1 = Throttle-valve switch (full load).  
The throttle-valve switch, idle (not visible in picture) is located on the underside of the throttle-valve assembly.
- 2 = Start valve
- 3 = Idle actuator

- 4 = Temperature sensor (engine)
- 5 = Injection valves
- 6 = Pressure actuator
- 7 = Potentiometer at air-flow sensor
- 8 = Fuel distributor
- 9 = Fuel filter

INSTALLATION POSITION OF COMPONENTS (in picture: AUDI 100)

# INSTALLATION POSITION OF COMPONENTS (CONTINUED)

## AUDI 100:

- \* EI-K control unit:  
In driver's footwell.
- \* Altitude sensor:  
Above EI-K control unit.  
The components are accessible following removal of the shelf, the release mechanism for the bonnet and the side trim.
- \* KE-control unit:  
In passenger-side footwell. The control unit is accessible following removal of the shelf and the side trim.
- \* Fuel accumulator:  
On vehicle underfloor between rear axle and fuel tank.
- \* Pressure regulator:  
Next to mixture-control unit in right-hand wheel house.
- \* Activated carbon filter with tank-ventilation valve:  
Next to mixture-control unit in right-hand wheel house.
- \* In-tank electric fuel pump:  
Accessible from trunk. To remove, take out trunk mat and unscrew round closing cover (3 screws).
- \* Catalytic converter and lambda sensor:  
In exhaust system, in area behind front axle.

# INSTALLATION POSITION OF COMPONENTS (CONTINUED)

## AUDI 90:

- \* EI-K control unit:  
On side in passenger's footwell, accessible following removal of side trim.
- \* Altitude sensor:  
above EI-K control unit.
- \* KE-control unit:  
Behind glove compartment, accessible following removal of lower trim (2 screws).
- \* Injection valves:  
Installed as in AUDI 100, however not readily accessible due to different intake-manifold design.  
To improve accessibility, detach intake manifold at individual pipes.
- \* Fuel supply components:  
The electric fuel pump, fuel accumulator and fuel filter are located on the underside of the vehicle in the area ahead of the rear axle.
- \* Catalytic converter and lambda sensor:  
In exhaust system in area behind the front axle.
- \* Activated carbon filter:  
At left-hand wheel house; tank-ventilation valve is located at air scoop of air-flow sensor.

Trouble-shooting instructions : BMW-5014

BOSCH system : ABS

Make of vehicle : BMW

Basic microcard : PKW-040

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SPECIAL FEATURES

This microcard, valid at the time of publication, applies to the following vehicle models:

BMW 730 i (E 32), 9.86 ->

BMW 735 i (E 32), 9.86 ->

BMW 750 i (E 32), 9.87 ->

BMW 750 iL (E 32), 9.87 ->

- \* ABS with 4 wheel-speed sensors and 4 hydraulic channels.
- \* Sensor ring gear with 48 teeth.
- \* Note:  
Vehicles with ABS/ETC have their own instructions.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

For a detailed description of trouble-shooting, see the basic instructions.

ATTENTION :  
The set values, terminal assignments and special features of these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

- \* For safety reasons, the hydraulic modulator must not be repaired, but be exchanged as a complete unit.  
Exception: relays.
- \* Do not loosen any screws on the hydraulic modulator!  
Danger of fatal accident due to brake failure.
- \* Caution when handling brake fluid.  
Poisonous!

For further information, see basic instructions.

## TEST REQUIREMENTS FOR TESTING WITH ABS2 LED TESTER

- \* Regulatory tire size fitted?
- \* Check for firm seating of ground of return-supply pump.
- \* Check for firm seating and corrosion of ground of overvoltage-protection relay term. 31.
- \* Check for firm seating of ground strap between engine block and vehicle frame.
- \* Check for leaks in hydraulic connections at hydraulic modulator and sealing points (visual examination).
- \* If the ABS warning lamp lights up intermittently when driving (e.g. after switching on loads) and goes out again by itself, check the battery and power supply (alternator, regulator and voltage drops).
- \* If the ABS warning lamp lights up constantly and does not go out, check the following points:
  - Controller plug sitting correctly on controller and latched?
  - All plug contacts O.K.?
  - Spring contacts latched?
  - Check installation position for correct seating of seal ring in controller plug, rounded side downward.

- Check wheel-speed-sensor leads for correct assignment at controller plug:

### Wheel-speed sensors:

front left to term. 6 and term. 4.  
front right to term. 11 and term. 21.  
rear left to term. 7 and term. 9.  
rear right to term. 24 and term. 26.  
rear axle to term. - and term. -.

- V-belt snapped?  
(Alternator provides no voltage, charge-indicator lamp and ABS warning lamp light up).
- \* Connect ABS 2 LED tester to ABS wiring harness.
- Disconnect and connect controller only with ignition switched off.
- For testing, switch on ignition in all program-selector-switch positions (tester operates with current supply from vehicle battery).
- Observe LED (green) for current supply in all program-selector-switch positions.

## C A U T I O N !

Do not drive with tester connected!

The brake system must be bled of air before the ABS test. Do not activate the ABS tester while the system is being bled.

Repeat the complete test program after any repairs are carried out.

The Antiskid System is a vehicle safety system.

Work on the system demands detailed knowledge of the system.

The conventional brake system must be O.K.

### General information for trouble-shooting:

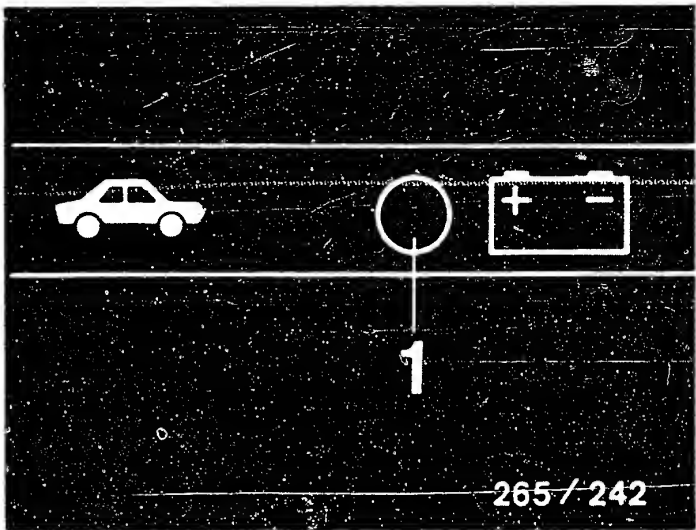
Check all leads for short circuit to ground and contact with positive leads and watch out for worn cable insulation and pinched leads.

RAPID DIAGNOSIS CHART

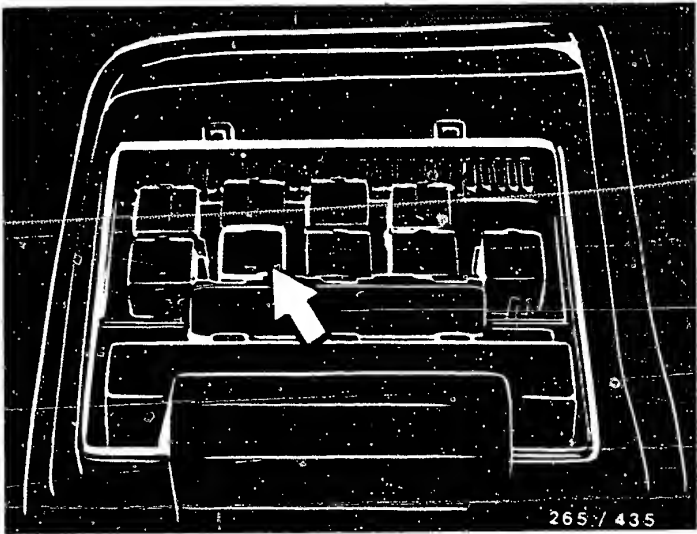
Do not drive with tester connected. Are all test conditions met?

Program-switch positions 1 to 6

Testing of (measurement at terminals)	Additional operation	Test specifi- cation (reading)	Possible causes of faults
Power supply  (term.1 und term.20)	Ignition on	LED 1 (top picture) continuously lit	<ul style="list-style-type: none"><li>*Battery insufficiently charged</li><li>*High voltage drops</li><li>*Overvoltage-protection relay defective</li><li>*Check lead to driving switch term.15</li></ul>



Arrow = Overvoltage-protection relay



Program-switch position 1 (4-channel hydraulic modulator)

1 2 3 4.1 4.2 4.3 4.4

4

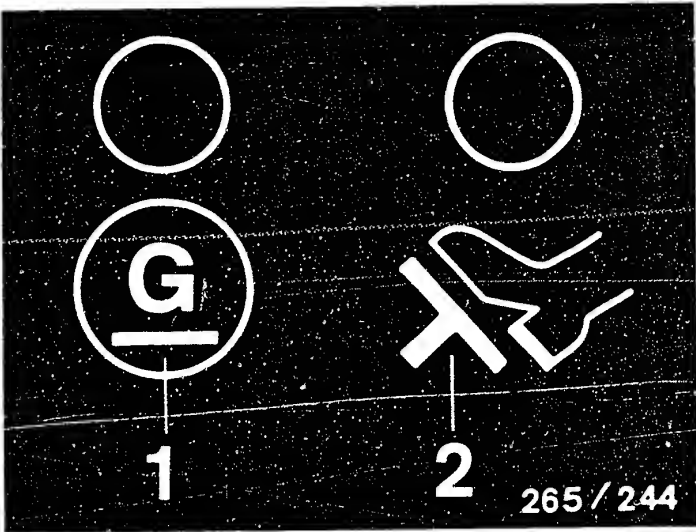
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RAPID DIAGNOSIS CHART (CONTINUED)

Program switch setting 2

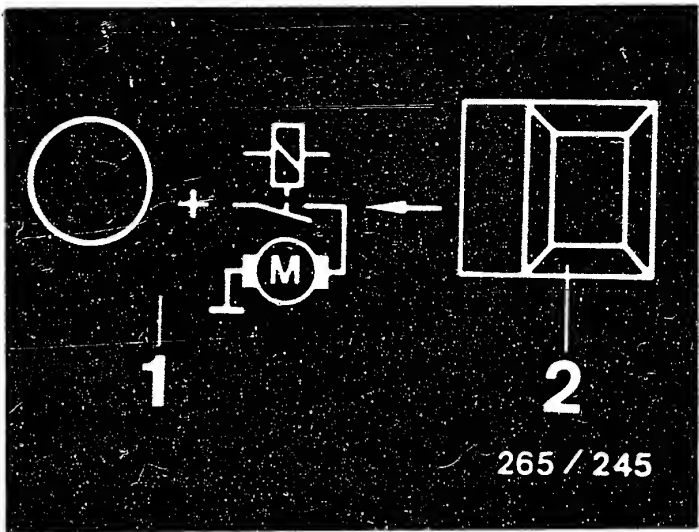
Testing of (measurement at terminals)	Additional operation	Test specifica- tion (indication)	Possible causes of fault
Alternator voltage of term.61 (term.15)	Ignition on	LED 1 (top picture) lights up.	* LED sometimes only goes out after accelerating (test is thus O.K.)
	Start engine	LED 1 (top picture) goes out when engine running	* Test lead to alternator term.61  * Alternator defective.
Brake-light switch (term.25)	Ignition on	LED 2 (top picture) lights up	* Brake-light switch defective.  * Test lead to brake-light switch.
	Depress brake pedal	LED 2 (top picture) goes out	* Lead incorrectly connected to brake-light switch.



RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 3

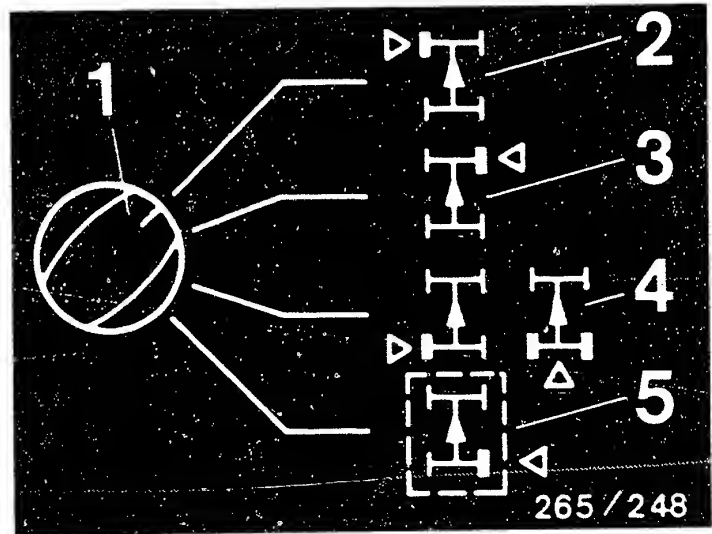
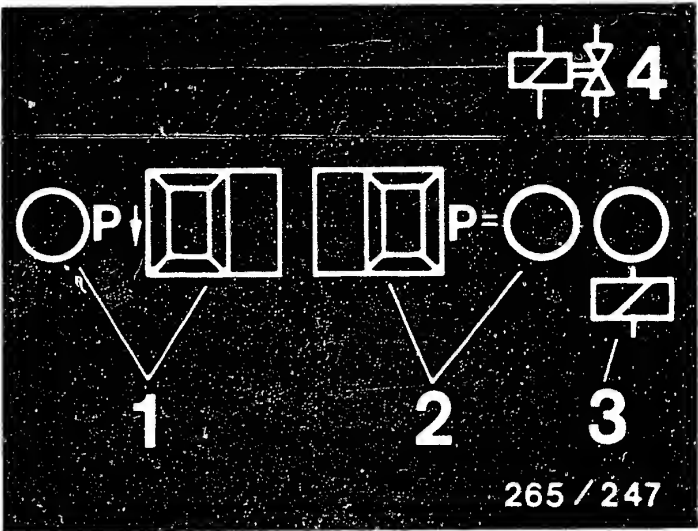
Under test (measurement at the terminals)	Additional operation	Test specifications (reading)	Possible causes of trouble
Motor relay, pump motor in hydraulic modulator (term.14 and term.28)	Ignition on, constantly press push- button 2 (upper ill- ustration)	LED 1 lights up, pump motor runs.  After releasing push-button, LED stays lit due to run-on of motor (upper illustration).	<ul style="list-style-type: none"><li>* Motor relay defective</li><li>* Check frame connection and positive terminal of pump motor</li><li>* Check following leads: from controller term. 14 and term. 28 to hydraulic modulator term. 11 (12: 09.87-&gt;) or term. 2 (8: 09.87-&gt;). Positive lead to hydraulic modulator term. 4.</li><li>* Pump motor or hydraulic modulator defective.</li></ul>



Program-selector-switch position 4 not applicable.

RAPID DIAGNOSIS CHART (CONTINUED)  
Program switch setting 5 (4-channel hydraulic modulator)

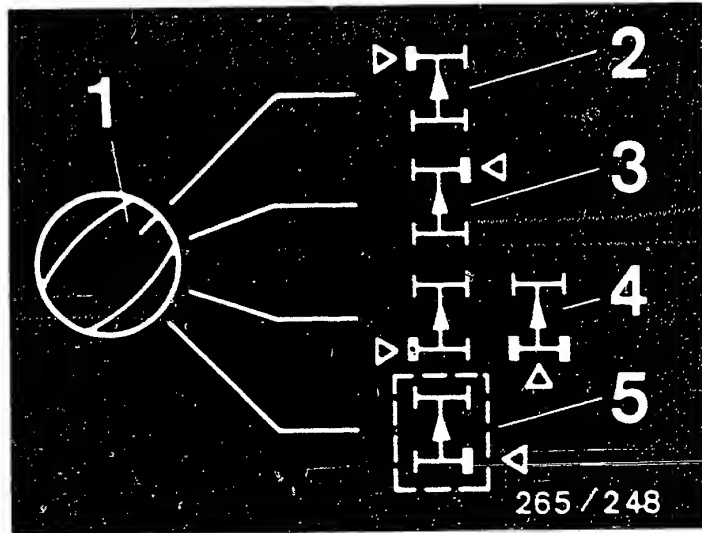
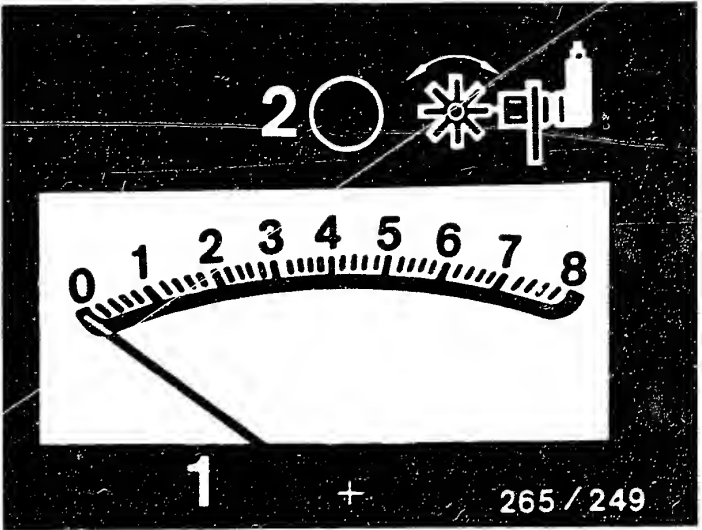
Testing of (measurement at terminals)	Additional operation	Test specification (indication)	Possible causes of fault
Valve relay func- tion (term. 27)	Ignition on	LED 3 (top picture) lights up	* Valve relay (winding) or leads defective
Check solenoid valves in hydraulic modu- lator for proper functioning and mix-up. NOTE: Perform test con- secutively for each individual wheel. Comply with operating sequence!	Check up vehicle. Ignition on. It must be possible to turn the wheel to be tested freely by hand. Set switch 1 for wheel selection to wheel to be tested (bottom picture).		* Repeat test with engine running  * Valve relay (make contact) defective  * Open-circuit in lead from valve relay, term. 87 to B+  * Brake lines mixed up at hydraulic modulator
Function Pressure retention	1. Press button P= (top picture) constantly	LED P= (top picture) lights up	* Current value is not attained (LED P arrow or P= off; top picture): Insufficient battery charge. Repeat test with engine running.
	2. Constantly depress brake pedal	Wheel can be turned by hand	
	3. Release button P= (top picture)	LED P= goes out (top picture) Wheel locks	
Function Pressure reduction	4. Press button P arrow (top picture)	LED P arrow (top picture) lights up, wheel can be turned by hand	* Proper electrical connection of solenoid valves? Front left wheel: term. 2 Front right wheel: term.35 Rear left wheel: term.18 Rear right wheel: term.19 Rear axle: term.—  * Hydraulic modulator defective
	5. Release button P arrow (top picture)	LED P arrow (top picture) goes out, wheel locks	
	6. Release brake pedal		



RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 6 (4 wheel-speed sensors)

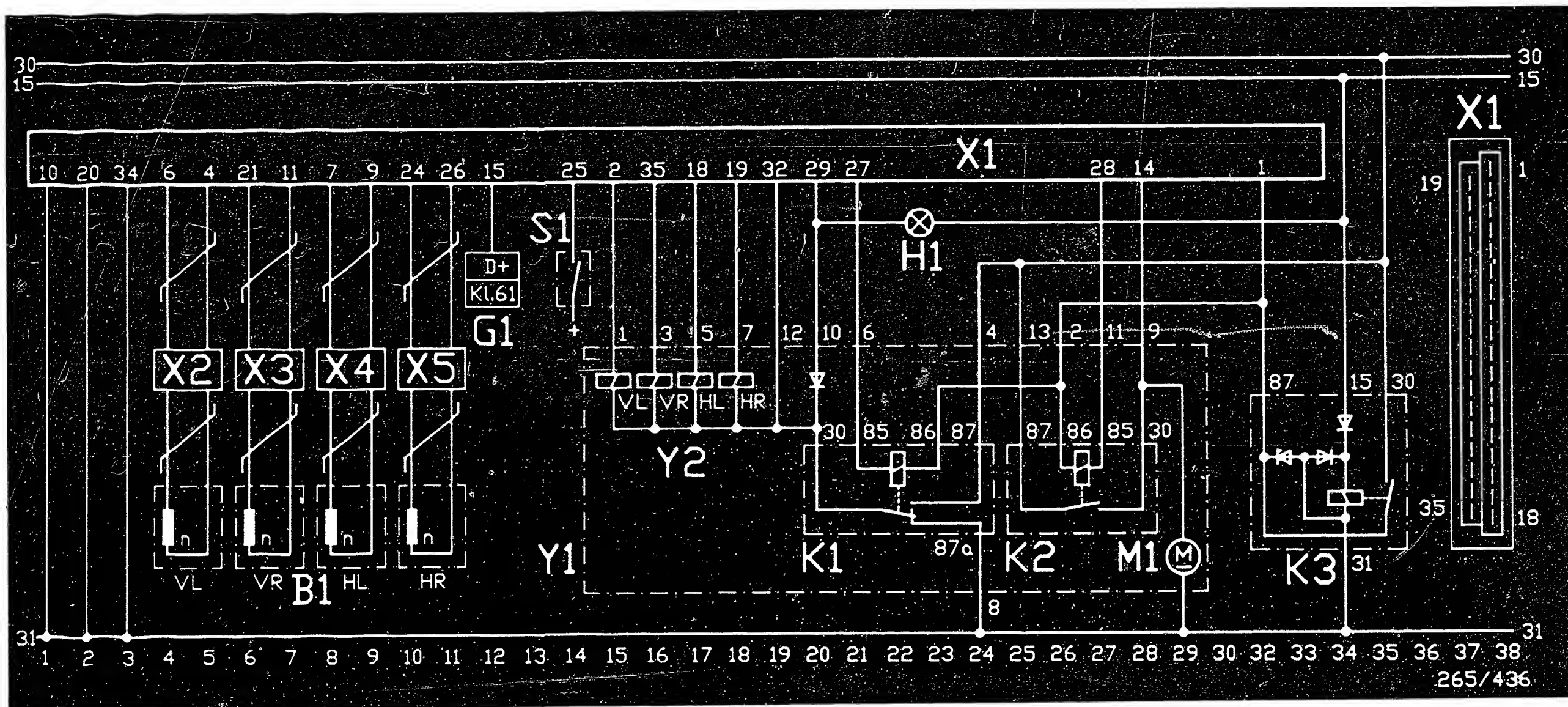
Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
<p>Wheel-speed sensor for operation and mix-up</p> <p>NOTE: Check each wheel separately in turn.</p> <p>(Wheel, front left: term.4 and term.6</p> <p>Wheel, front right: term.11 and term.21</p> <p>Wheel, rear left: term.7 and term.9</p> <p>Wheel, rear right: term.24 and term.26)</p>	<p>Chock-up vehicle. Ignition on.</p> <p>The wheel being tested must be freely turn- able by hand.</p> <p>When testing the driven axle, the wheel not being tested must be locked.</p> <p>Set switch for wheel selection to wheel to be tested (lower illustration)</p> <p>Turn wheel by hand until LED 2 above instrument lights up without flickering. (Wheel speed approx. 1 revolution per second). Afterwards, read off indication at instrument: (upper illustration)</p>	<p>1. Smallest reading larger 1,6 divisions</p> <p>2. Permissible fluctuation max. 25 % of largest reading.</p>	<p>*Wheel-speed-sensor lead mixed up</p> <p>*Brake in wheel-speed- sensor lead</p> <p>*Wheel-speed sensor defective</p> <p>Winding resistance Front axle: 0,6...1,6 k <math>\Omega</math></p> <p>Rear axle: 0,6...1,6 k <math>\Omega</math></p> <p>*Air gap between wheel- speed sensor and ring gear too wide</p> <p>*Ring gear defective or loose</p> <p>*Ring gear with incorrect number of teeth Front axle: 48 teeth Rear axle: 48 teeth</p> <p>*Wheel-bearing clearance too large</p> <p>*Instrument gives reading, LED 2 does not light up: loose contact in wheel- speed sensor lead.</p>



TEST SPECIFICATIONS

Wheel-speed sensor		
* Winding resistance at ambient temperature (-10°C...+120°C) for		
Front axle:	600...1600	Ω
Rear axle:	600...1600	Ω
Hydraulic-modulator solenoid-operated valves		
* Winding resistance at ambient temperature (-10°C...+120°C):	0,7...1,7	Ω
Air gap:	0,8 ± 0,5	mm
Tightening torque for		
* Fastening screws of wheel-speed sensors:	> 8	Nm
* Brake-line connections on hydraulic modulator:	12...16	Nm
Number of teeth		
* Front axle:	48	teeth
* Rear axle:	48	teeth

For production reasons:  
continued on the following  
coordinate.



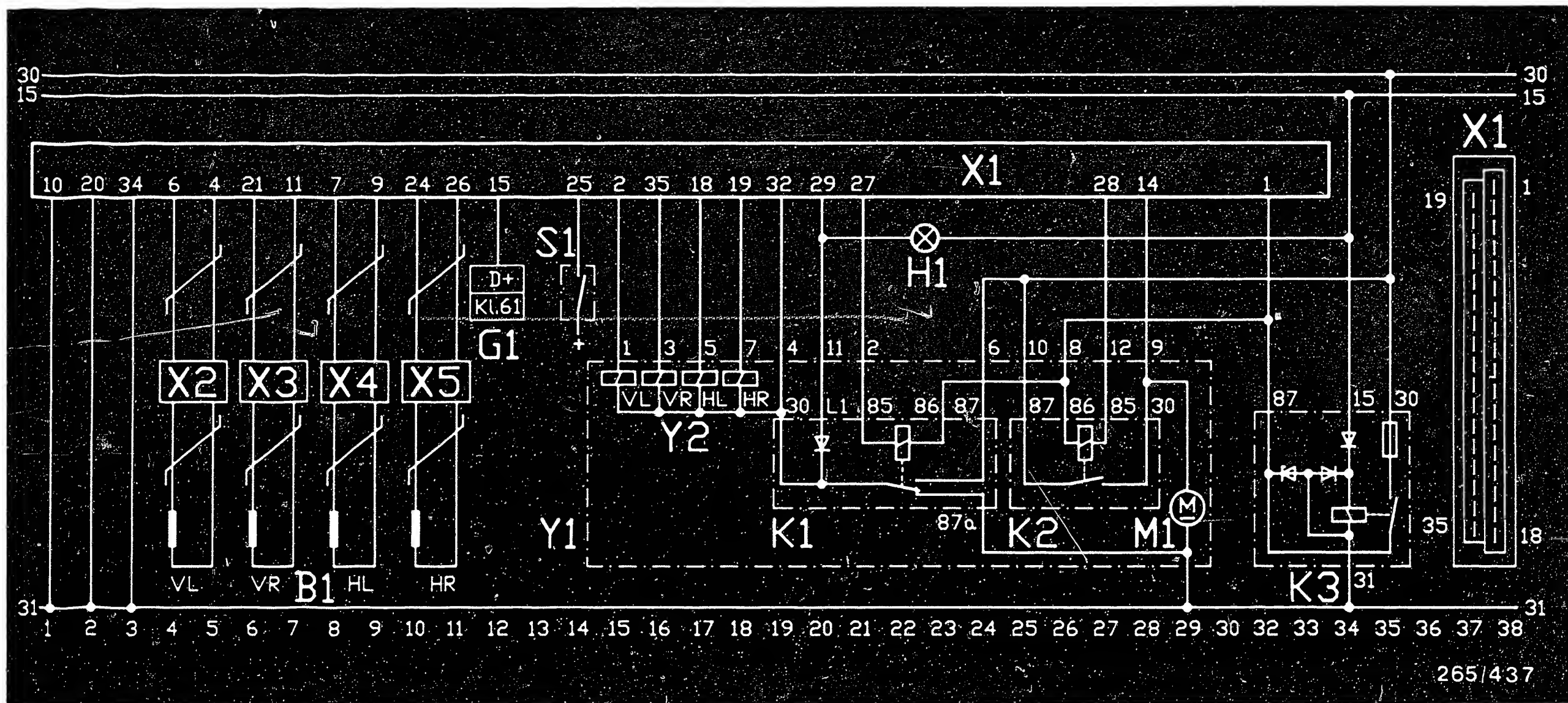
B1 = Engine-speed sensor  
 G1 = To alternator  
 H1 = ABS warning lamp  
 K1 = Valve relay  
 K2 = Motor relay

K3 = Overvoltage-protection relay  
 M1 = Return-supply-pump motor  
 S1 = Stop-lamp switch  
 X1 = Controller plug (35-pin)  
 X2...X5 = Engine-speed-sensor plug

Y1 = Hydraulic modulator  
 Y2 = Solenoid-operated valves  
 HL = Rear left  
 HR = Rear right  
 VL = Front left  
 VR = Front right

ELECTRICAL TERMINAL DIAGRAM 09.86 -> 08.87



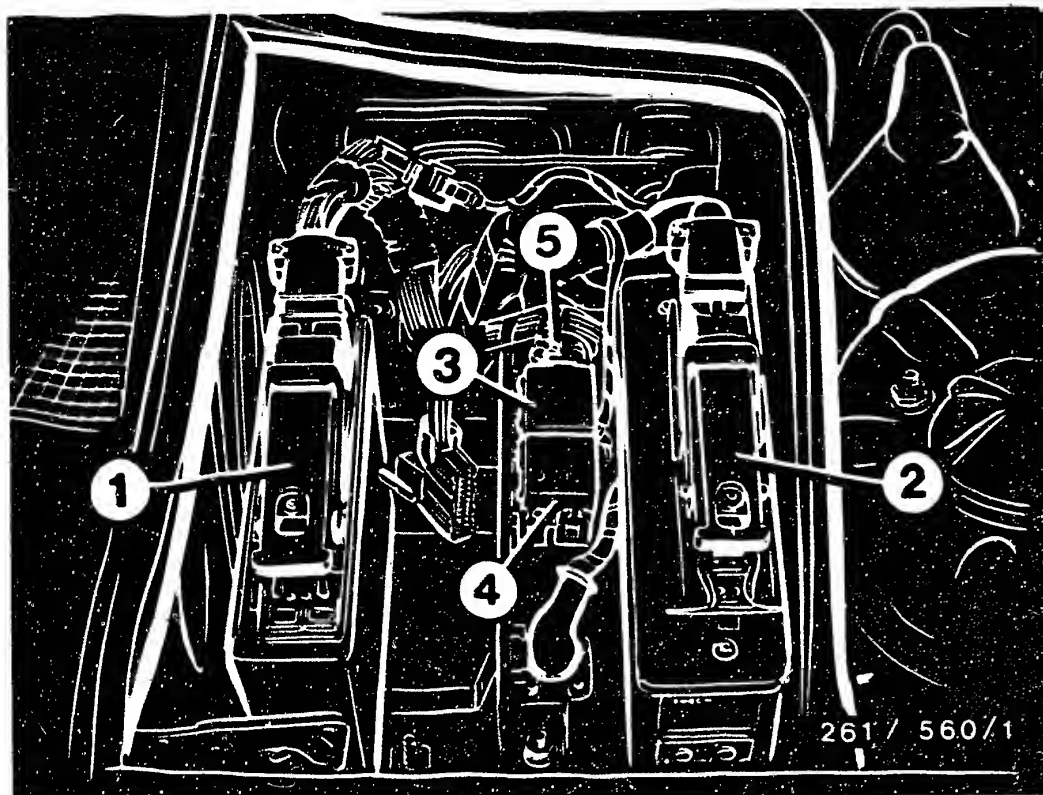


B1 = Engine-speed sensor  
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 S1 = Stop-lamp switch  
 X1 = Controller plug (35-pin)  
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Y1 = Hydraulic modulator  
 Y2 = Solenoid-operated valves  
 HL = Rear left  
 HR = Rear right  
 VL = Front left  
 VR = Front right

ELECTRICAL TERMINAL DIAGRAM 09.87 ->



1 = Motronic control unit in 735i  
2 = ABS controller

#### INSTALLATION POSITION OF COMPONENTS

##### ABS controller:

In the engine compartment beneath the hood on the right-hand side.

Unscrew cover.

Remove plug:

Lift up latching clip or, as the case may be, push back spring and unhook plug from the mechanical encoder at the wiring-harness end.

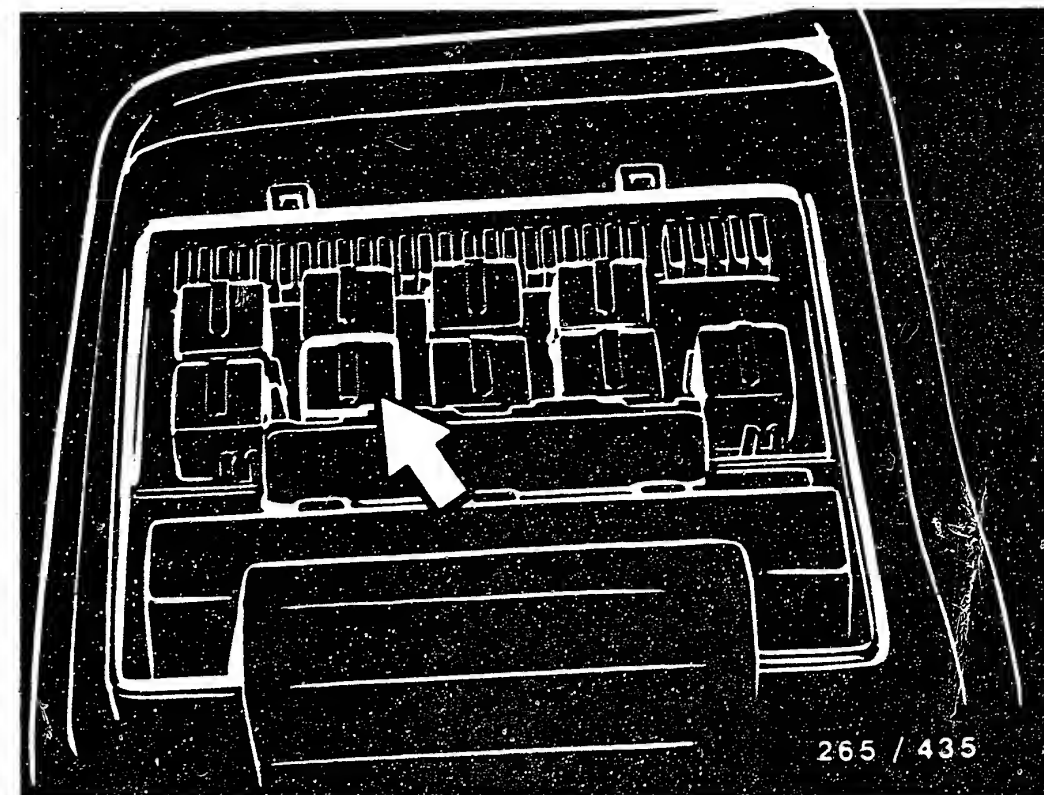
##### ABS warning lamp:

In the instrument cluster.

Marking: ABS.

##### Ground terminal:

In the engine compartment at the control-unit box on the left beneath a cover.

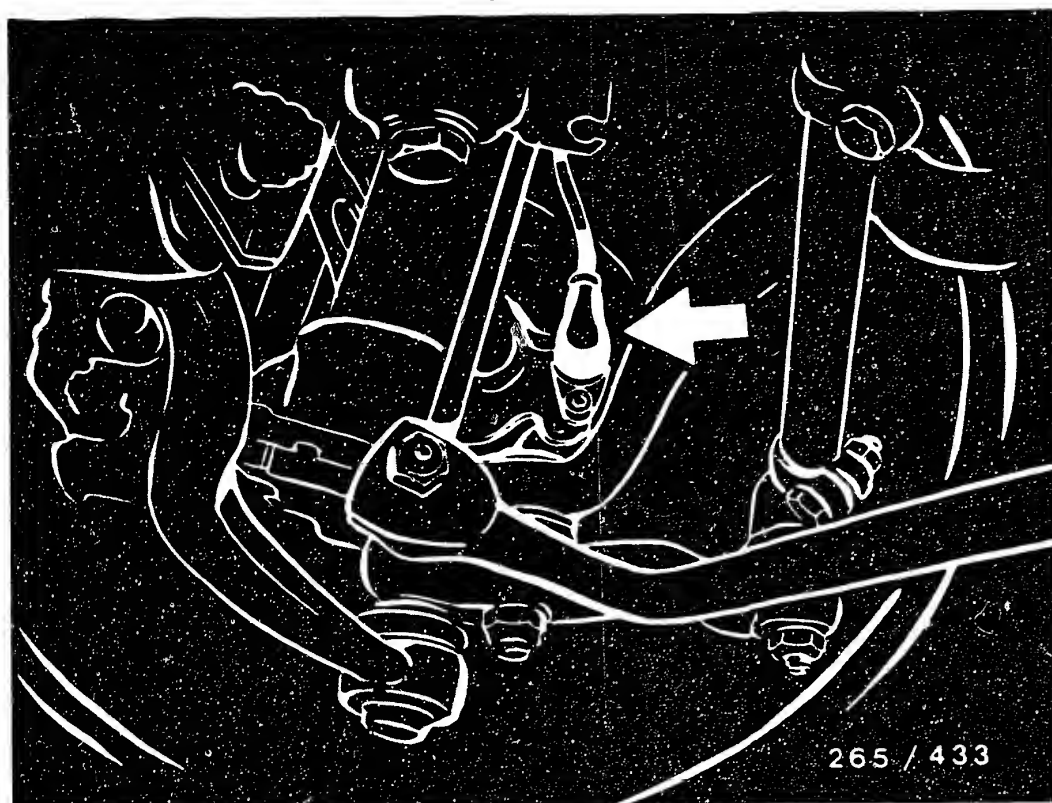


Arrow = Overvoltage-protection relay

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

##### Overvoltage-protection relay:

In the fuse and relay box. Relay box in the engine on the left in front of the firewall compartment.



Arrow = Engine-speed sensors, front

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

##### \* Hydraulic modulator:

730i, 735i:

In the engine compartment on the left-hand side in front of the brake master cylinder.

750i (L):

In the engine compartment behind the left-hand headlamp. The hydraulic modulator must not be repaired, but must be exchanged only as a complete unit.

Exception: The relays may be exchanged.

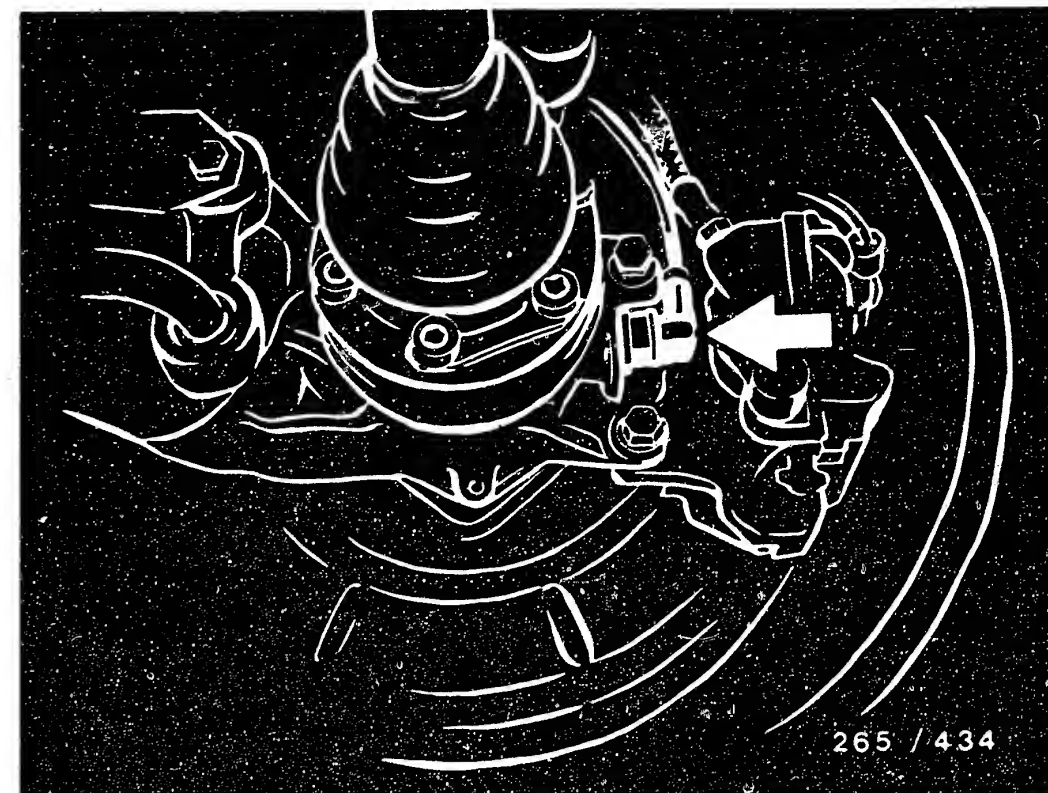
Make sure that the brake-line connections are not mixed up.

##### \* Wheel-speed sensors, front axle:

One on each side in the steering knuckles.

Wheel-speed-sensor plug-in connections:

In the engine compartment in the left and right wheel houses.



Arrow = Wheel-speed sensors, rear

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

##### \* Wheel-speed sensors, rear axle:

One on each side in the rear-axle trailing arm. To exchange, remove a wheel and loosen brake caliper.

Wheel-speed-sensor plug-in connections::

Behind the leadthroughs in the floor panel; that is, on the left and right beneath the rear seat bench.

Trouble-shooting instructions : JAG-5001  
BOSCH system : LH-Jetronic  
Make of vehicle : JAGUAR  
Basic microcard : SAA-504

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Test specifications.....	15
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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following vehicle models:

JAGUAR XJ 6 09.86->  
with 2.985 l / 6-cyl. engine

EU model without catalytic converter  
EU, A, AUS, CH and J models with catalytic converter

- \* Control unit 0 280 001 500 for EU model without catalytic converter.
- \* Control unit 0 280 001 509 for A, AUS, CH, J models with catalytic converter.
- \* Control unit 0 280 001 501 for EU model with catalytic converter.
- \* Engine-speed triggering at control unit term. 1 from term. 1 of the ignition coil.
- \* Lambda closed-loop control with heated sensor.
- \* Double temperature sensor (engine) for Jetronic and ignition.
- \* Low-idle-speed control with two-winding rotary actuator.
- \* Starting control, i.e. additional quantity of fuel injected via all solenoid-operated injection valves.
- \* For testing the fuel pressure, connect pressure tester with connecting piece KDJE-P 100/14 to pressure-regulator inlet.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!  
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

\* Avoid injection of fuel when testing the compression.  
To ensure this, disconnect pump relay.

For further precautionary measures, see brief instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
*	*	*	*	*	*	*	*	*	*	Universal test adapter
*										Electric fuel pump
*	*	*	*							Auxiliary-air device/idle actuator
*	*	*	*	*	*	*	*			Air-flow sensor/air-mass sensor
*	*	*	*		*					Intake system
		*	*	*		*	*			Solenoid-operated injection valves
*	*	*			*	*				Fuel pressure
				*	*					Fuel quantity
		*	*	*	*	*				Throttle valve
				*						Overrun cut-off
*		*								Start control
				*						Ground
*	*	*	*	*	*					Alternator, interference suppress.
		*	*	*		*				CO exhaust-gas adjustment
				*						Control unit
						*				Catalytic converter
		*	*	*	*					Lambda closed-loop control



RAPID DIAGNOSIS CHART FOR UNIVERSAL-TEST ADAPTER ETT 018.01  
 Adapter lead: 1 684 463 141

Test step	Switch V	$\Omega$	Termi- nals	Testing of component/function	Test instructions/ Test conditions	Set values
1	 V	5	2 - 11	Resistance, temperature sensor (engine)	Connect adapter lead only to periphery.  +15...+30°C: Approx. +80°C:	1.45...3.3 k $\Omega$ 280...360 $\Omega$
2	 V	6	25 - 11	Frame connection of output stage		0...10 $\Omega$
3	 V	7	5 - 11	Frame connection of sensors		0...10 $\Omega$
4	 V	8	13 - 11	Resistance of shunt- connected solenoid- operated injection valves and lead of sensor heater	Disconnect sensor-heater plug and insert short-circuit wire bridge into the wiring-harness side of the plug.  +15...+30°C: Approx. +80°C:	5,7...8,0 $\Omega$ 6,0...8,4 $\Omega$
5	 V	9	3 - 11	Resistance of idle contact	Accelerator pedal in rest position: Depress accelerator pedal slightly:	0...10 $\Omega$ Infinity $\Omega$
6	 V	10	12 - 11	Resistance of full-load contact	Accelerator pedal in rest position: Depress accelerator pedal to floor:	Infinity $\Omega$ 0...10 $\Omega$
7	 V	10	12 - 11	Resistance of low-idle- speed-control test pin	Apply test pin to ground.	0...10 $\Omega$
8	 V	11	10 - 11	Resistance of idle actuator, 1st winding	Sensor-heater plug remains bridged.  +15...+30°C: Approx. +80°C:	18...29,5 $\Omega$ 22...34 $\Omega$



# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: 1 684 463 141

Test step	Switch V	Ω	Termi- nals	Testing of component/function	Test instructions/ Test conditions	Set values
9	 V	12	23 - 11	Resistance of idle actuator, 2nd winding	Adapter lead remains connected at periphery. After testing, remove bridge from sensor-heater plug and connect sensor.	+15...+30°C: Approx. +80°C: 20...32 Ω 24,5...37 Ω
10	 V	13	15 - 11	Overrun-cutoff suppression (if fitted)	Select 1st or 2nd gear: Select 3rd or 4th gear:	0...10 Ω Infinity Ω
11	 V	21	14 - 6	Resistance, idle-mixture potentiometer	Dependent upon the CO adjustment	10...1000 Ω
12	5	21	1 - 11	Voltage pulses from ignition coil term. 1	Shift into neutral, start engine	Ignition pulses on oscilloscope
13	6	21	9 - 11 (+) (-)	Voltage from main relay term. 87	Press push-button 4	8...15 V
14	7	21	18 - 11 (+) (-)	Voltage from ignition and starting switch	Ignition "ON"	8...15 V
15	8	21	21 - 11 (+) (-)	Voltage at main relay term. 85		8...15 V
16	9	21	17 - 11 (+) (-)	Voltage at pump relay term. 85	Press push-button 4	8...15 V

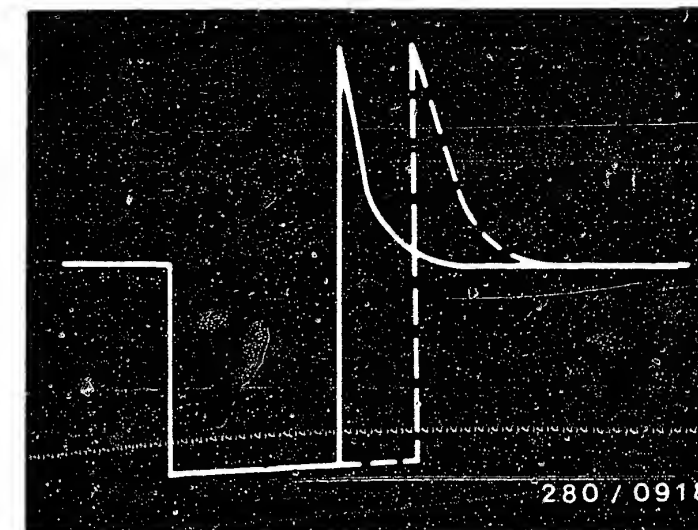
# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: 1 684 463 141

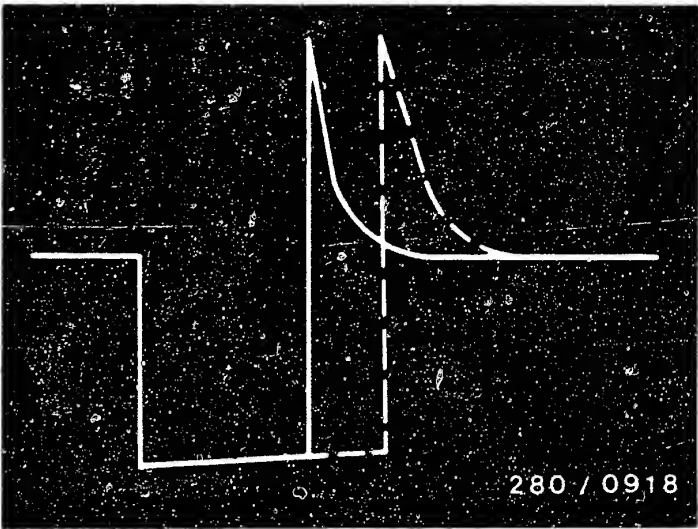
Test step	Switch V	Termi- nals	Testing of component/function	Test instructions/ Test conditions	Set values
17	10	21	16 - 11 Voltage at air- conditioner switch (only if air conditioner fitted)	Connect adapter lead to periphery and control unit. Leave engine running. Switch on air conditioner.	8...15 V
18	3	21	7 - 6 Output voltage, hot-wire air-mass sensor	Leave engine running. The output voltage must change when the engine speed changes.	2...5 V
19	11	21	22 - 11 Voltage at integrator output, lambda closed- loop control (open-loop- control value)	Leave engine running until at normal operating temperature.	10...13 V
20	11	22	22 - 11 Voltage at integrator output, lambda closed- loop control (rich value)	Leave engine running until at normal operating temperature.	10...13 V
21	11	23	22 - 11 Voltage at integrator output, lambda closed- loop control (lean value)	Leave engine running until at normal operating temperature.	Less than 0.5 V
22	11	24	22 - 11 Voltage at integrator output, lambda closed- loop control (closed- loop-control value)	Leave engine running until at normal operating temperature. Conduct measurement at approx. 2500 min <sup>-1</sup> .	0...13 V fluctuating
23	11	24		Basic idle speed	Not applicable

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01  
 Adapter lead: 1 684 463 141

Test step	Switch	Ω	Terminals	Testing of components/function Test instructions/conditions	Set values
24	11	24		On/off ratio at idle actuator  Measurement with dwell-angle tester at sockets 1 and 2 Apply LFR* test pin to ground : Loosen LFR test pin from ground: In addition, switch on air conditioner (if fitted) : Accelerate; above 3000 min <sup>-1</sup> , on/off ratio must increase : (*LFR = Idle mixture control.)	       29,9 % 31...33 % 34...37 % > 36 %
25	12	24	13 - 11	Injection signal t <sub>1</sub>  Leave engine running (at normal operating temperature)..	See upper illustration
26	12	24	13 - 11	Injection signal t <sub>1</sub> Temperature sensor cold  Leave engine running (at normal operating temperature). Press push-button 1. Duration of injection, engine speed and CO content become greater.	See upper illustration
27	12	24	13 - 11	Injection signal t <sub>1</sub> Temperature sensor warm  Leave engine running (at normal operating temperature). Press push-button 2. Duration of injection must remain constant.	See upper illustration



Test	step	Switch	Termi-	Testing of component/function	Set values
		V	nals	Test instructions/conditions	
28	12	24	13 - 11	Injection signal t <sub>1</sub> Full-load enrichment  Leave engine running (at normal operating temperature). Press push-button 6. Duration of injection, engine speed and CO content become greater.	See upper illustration
29	13	24	8 - 11	Hot-wire air-mass flow sensor, self-cleaning operation  Engine must run at speed exceeding 2000 min <sup>-1</sup> and the engine temperature be greater than +60° C. Then, ignition "OFF" - voltage reading after approx. 4s.	2...5 V Reading duration approx. 1s.

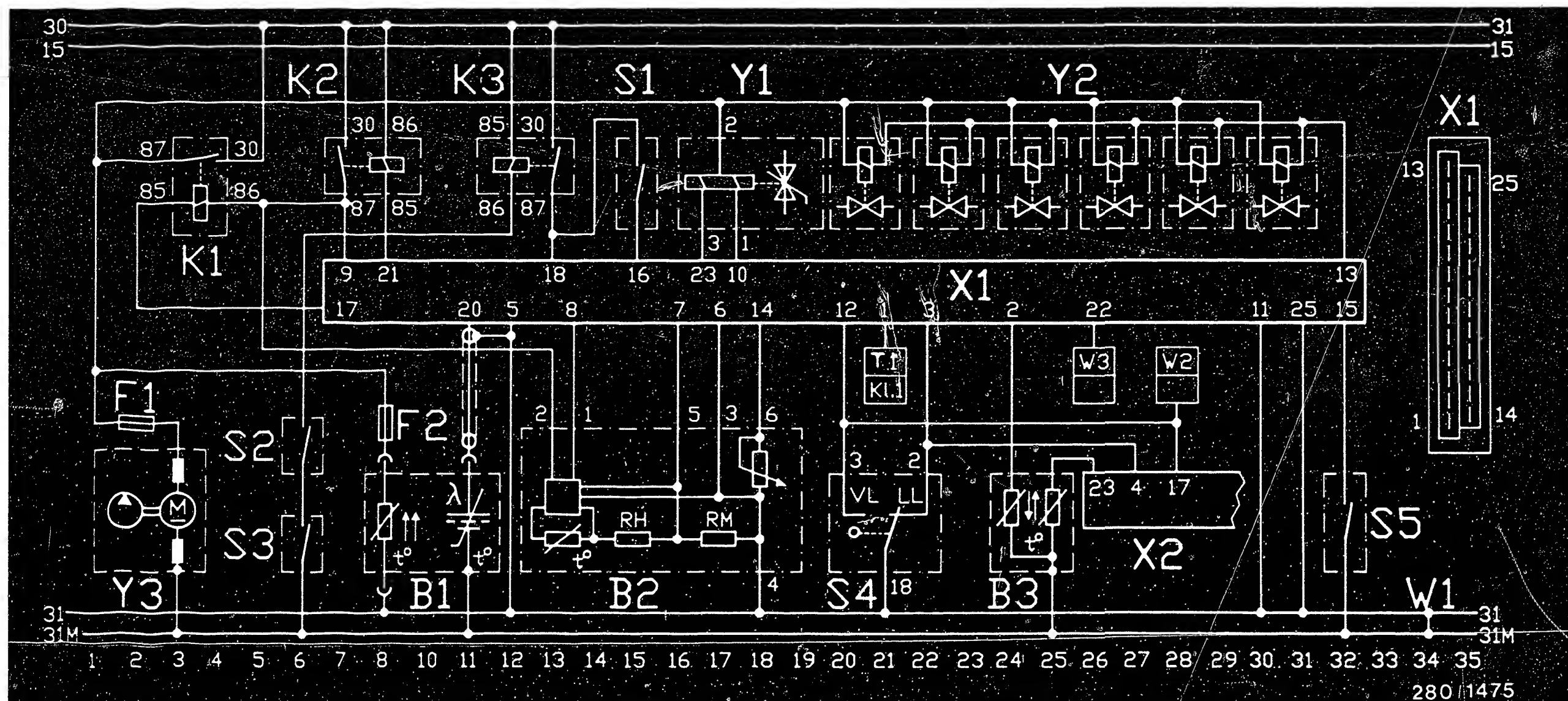


## TEST SPECIFICATIONS

Component/Function	Set values
Electric fuel pump	
* Fuel delivery at return:	at least 750 cm <sup>3</sup> /30 s
* Supply voltage under load:	at least 12 V
Pressure regulator	
* Fuel pressure with engine at standstill: at idle:	2,8....3,2 bar approx. 0.5 bar lower
Fuel system, leakages	
* Fuel pressure after 20 mins. with engine at standstill:	at least 1.0 bar
Idle actuator	
* Resistance value at +15...+30°C between term. 2 and term. 3:	17...22,5 Ω
term. 2 and term. 1:	19...25,0 Ω
Hot-wire air-mass sensor	
* Resistance value between term. 6 and term. 3:	0...1100 Ω
term. 5 and term. 3:	3.6...4.1 Ω
Temperature sensor (engine)	
Double version	
* Internal electrical resistance at ambient temperature +15...+30°C:	1.45...3.3 k Ω
with engine at norm. op. temp. approx. +80°C :	280...360 Ω

## TEST SPECIFICATIONS (Continued)

Component/Function	Set values
Solenoid-operated injection valve	
* Internal electrical resistance at ambient temperature +15...+30°C:	14.5...17.0 Ω
* Leakage after 60 s:	No drop must fall
Starting control	
* Voltage at injection valve on initiation of starting: after approx. 15 s.:	greater than 1.5 V approx. 0.5 V
Idle adjustment	
Engine at normal operating temperature, approx. 80° C	
* Idle speed:	600...700 min <sup>-1</sup>
with on/off ratio:	31... 33 %
CO adjustment	not applicable due to lambda closed-loop c
Integrator voltage	
* Closed-loop control (connected sensor must be hot)	
Indicator fluctuates between:	0...13 V
* Open-loop control (pull apart sensor lead):	10...13 V
* Rich value (sensor lead pulled apart and applied to ground on control-unit side):	10...13 V
* Lean value (apply 2 V to the sensor lead on control-unit side):	less than approx. 0.
Lambda-sensor heater	
* Internal electrical resistance	1...15 Ω



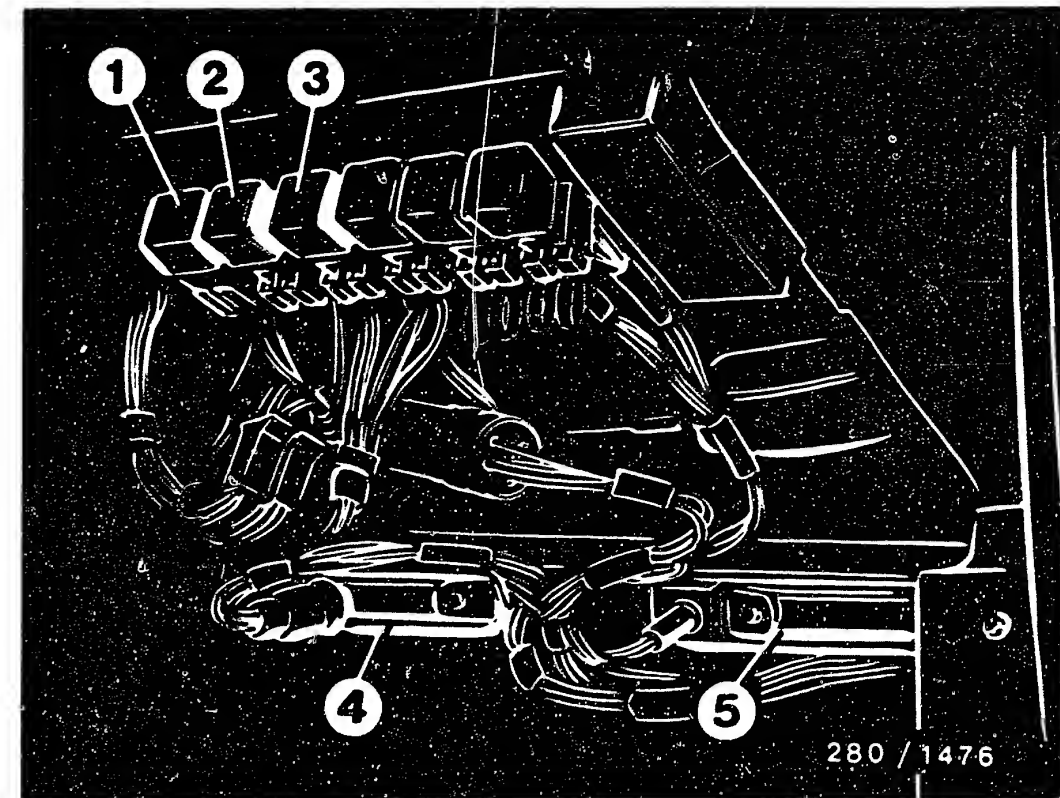
B1 = Heated lambda sensor  
 B2 = Hot-wire air-mass sensor  
 B3 = Temperature sensor II  
 (double version)  
 F1 = Pump fuse  
 F2 = Sensor fuse  
 K1 = Pump relay  
 K2 = Main relay  
 K3 = Ignition relay

S1 = Air-conditioner compressor  
 (if fitted)  
 S2 = Impact switch  
 S3 = Ignition and starting switch  
 S4 = Overrun-cutoff override  
 (if fitted)  
 S5 = Throttle-valve switch  
 T1 = Ignition coil  
 W1 = Ground strap (engine)

W2 = Test pin, low-idle-speed control  
 W3 = Integrator voltage  
 (lambda closed-loop control)  
 Y1 = Idle actuator  
 Y2 = Solenoid-operated injection valves  
 Y3 = Electric fuel pump  
 X1 = Control-unit plug (Jetronic)  
 X2 = Control-unit plug (ignition)

ELECTRICAL TERMINAL DIAGRAM

For production reasons:  
continued on the following  
coordinate.



- 1 = Pump relay
- 2 = Supply relay (ignition)
- 3 = Main relay
- 4 = LH-Jetronic control unit
- 5 = EI control unit

#### INSTALLATION POSITION OF COMPONENTS

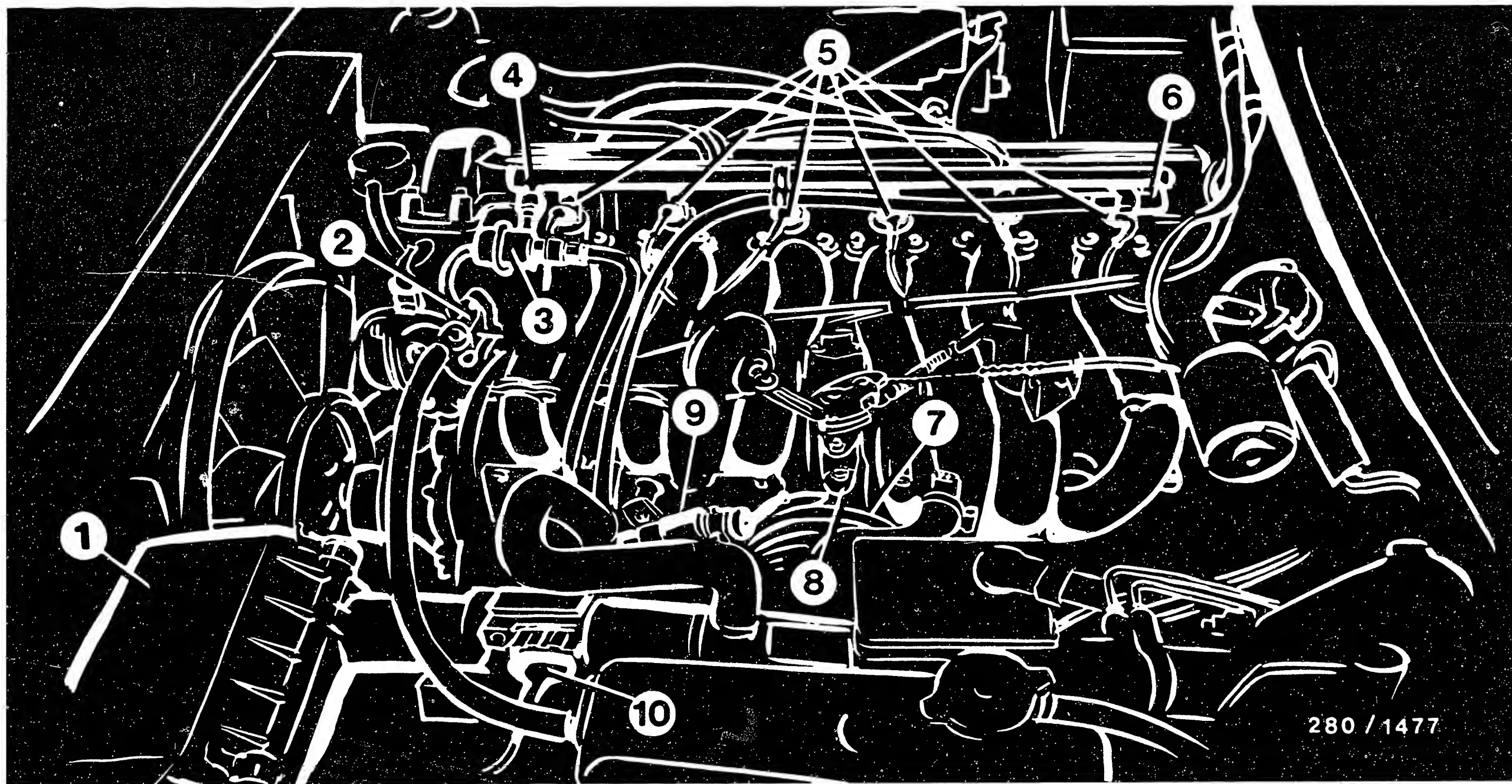
The indications "right" and "left" always refer to the forward direction of travel.

The control unit is located in the passenger compartment on the passenger's side beneath the glove compartment.

For connecting the universal test adapter, disconnect control-unit plug (25-pin).

To do this, press latch in direction of arrow.



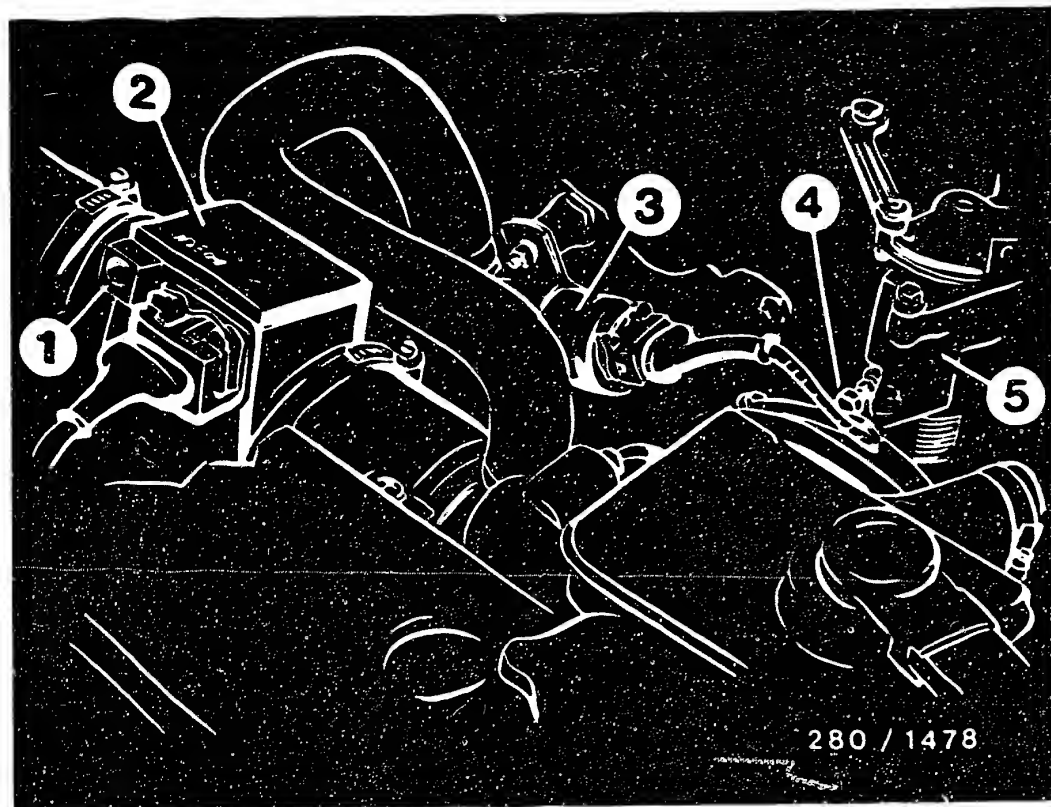


280 / 1477

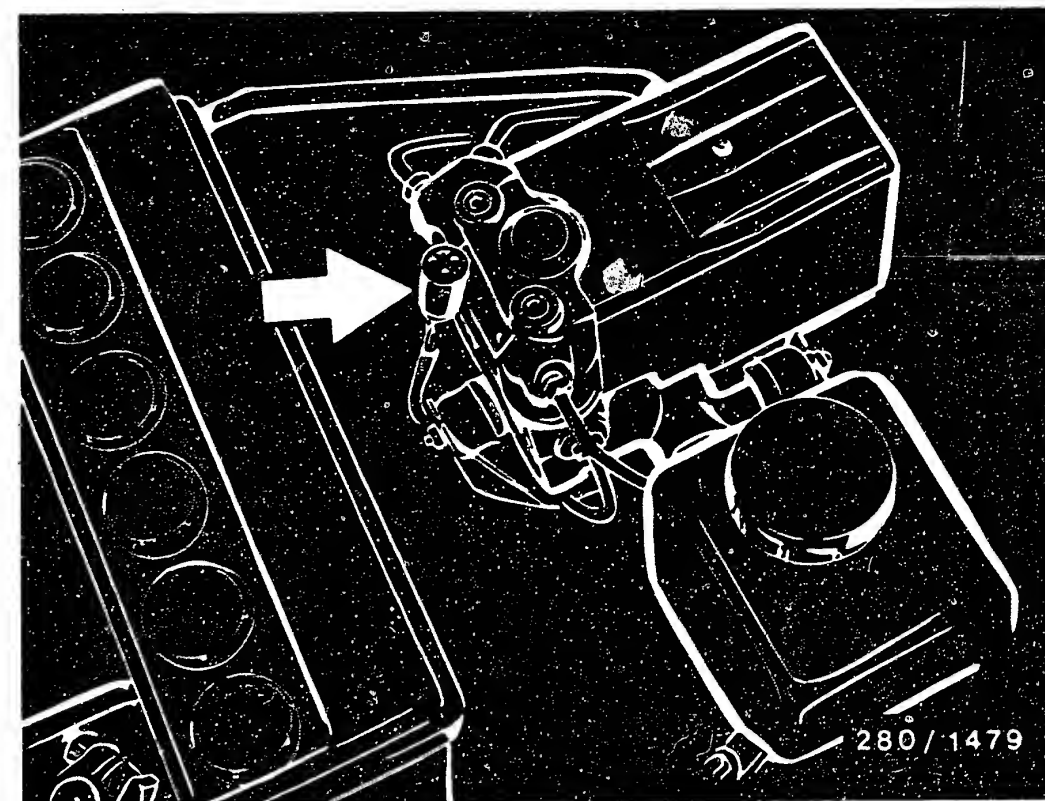
- 1 = Air filter
- 2 = Temperature sensor NTC II  
(double version)
- 3 = Pressure regulator
- 4 = Fuel-distribution pipe
- 5 = Solenoid-operated injection valves

- 6 = Pressure-measuring connection
- 7 = To throttle-valve switch
- 8 = Throttle housing
- 9 = Idle actuator
- 10 = Hot-wire air-mass sensor

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

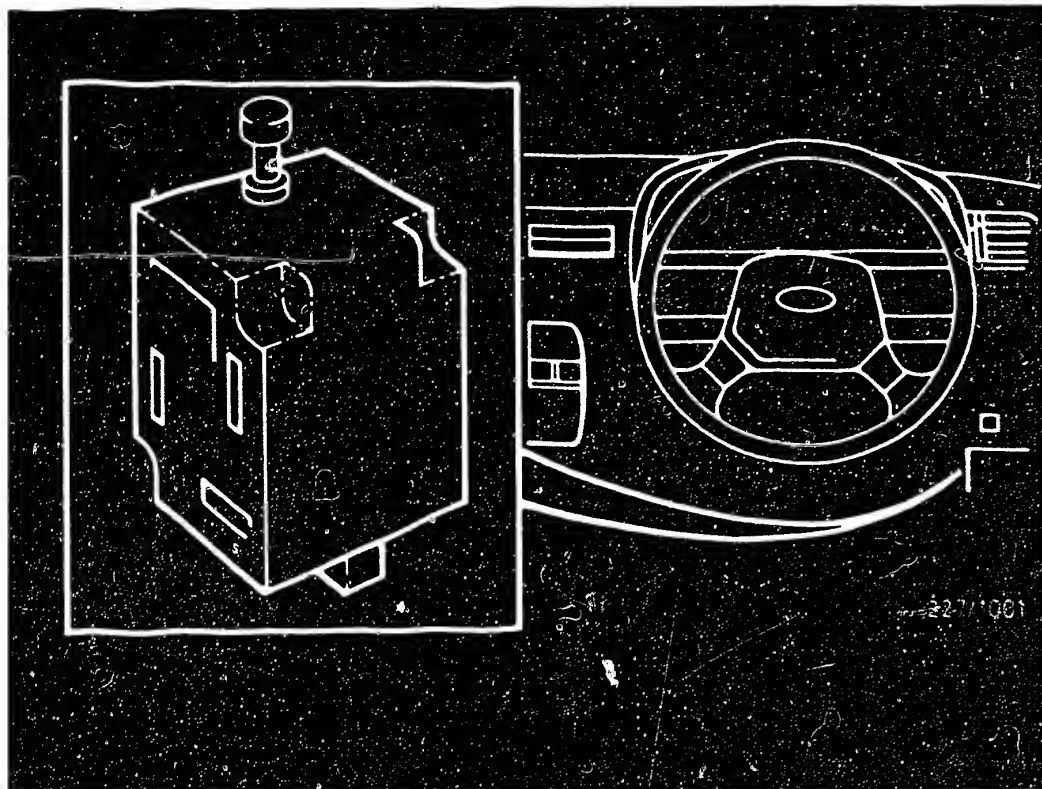


- 1 = CO adjusting screw
- 2 = Hot-wire air-mass sensor
- 3 = Idle actuator
- 4 = Idle-speed adjusting screw
- 5 = Throttle housing



Arrow = Test plug for integrator voltage  
and low-idle-speed control

Lead, white/black: integrator voltage  
Lead, white/blue: test pin, low-idle-  
speed control



#### Installation position of components (continued)

The impact switch is positioned on the driver's side behind the side panelling, see upper illustration.

In the case of a heavy impact (accident), the impact switch interrupts the voltage supply to the ignition system and electric fuel pump.

The switch can be reset by pressing the pin on the upper side of the housing.

For production reasons:  
continued on the following  
coordinate.

Trouble-shooting instructions: AUD-5009

BOSCH system : EI-K

Vehicle make : Audi

Basic microcard : PKW-051

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Self-diagnosis test table	07
Rapid diagnosis chart	13
Test specifications	21
Electrical terminal diagram	25
Installation position of components, instructions for removal and installation	27

## SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Audi model:

AUDI 90, 90 quattro, 2.3E  
Engine 2,3 l, 5 Zyl. 100 kW  
Identification letter NG.  
Year of manufacture 1987

- \*EI-K control unit 0 227 400 113, ..134
- \*Ignition coil with trigger box 0 221 600 050
- \*Ignition coil without trigger box 0 221 122 358
- \*Variant encoding
- \*Self-diagnosis (flashing code), additional test requirements:  
Fuses 13, 24, 28 O.K.  
Air conditioner off. Frame connection at intake manifold O.K.

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

Keep people away from danger.  
Prevent damage to the engine, trigger box  
and control unit, or ignition system.

\* C A U T I O N !

High-performance ignition system.  
Dangerous high and low voltages.

Do not touch voltage-carrying parts or terminals; risk of fatal injury on primary and secondary sides.

\*Before carrying out compression testing, remove the control-unit plug or connect ignition coil term. 4 firmly to ground with auxiliary cable.

**N o t e :** The auxiliary cable must be interference-suppressed to min. 2 k  $\Omega$ .

For further precautionary measures see the basic instructions.

## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Idle problems (engine speed, exhaust)
4. Poor throttle response.
5. Engine missing (ignition, injection)
6. Insufficient maximum power/speed
7. Excessive fuel consumption
8. Engine diesels
9. Engine pings/knocks
10. Engine overheats
11. Fault lamp.

											Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*				*							High-voltage side
*				*							Ignition coil
*											Firing sequence
*											Voltage - EI-K control unit
*											Ignition-distributor plug and socket
*											Voltage, magnetic pulse generator
*											Function, magnetic pulse generator
*											EI-K control units, function
*											Voltage, trigger box
*											Primary signal
*											Triggering, electric fuel pump relay

Customer complaint (symptoms of trouble)

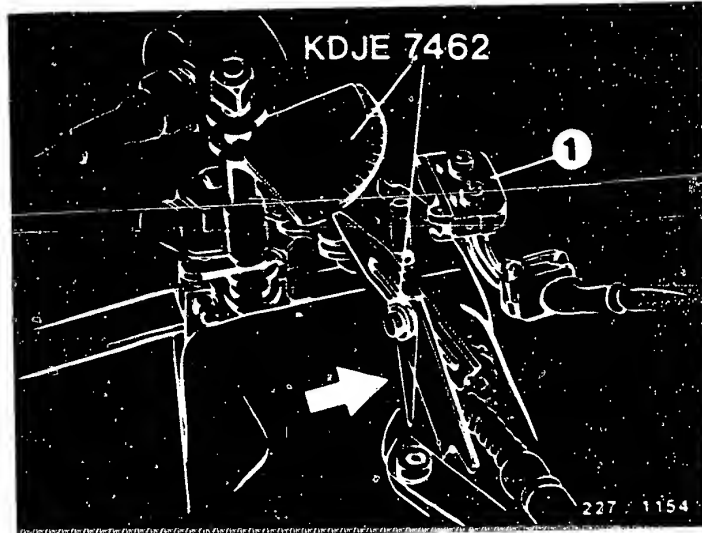
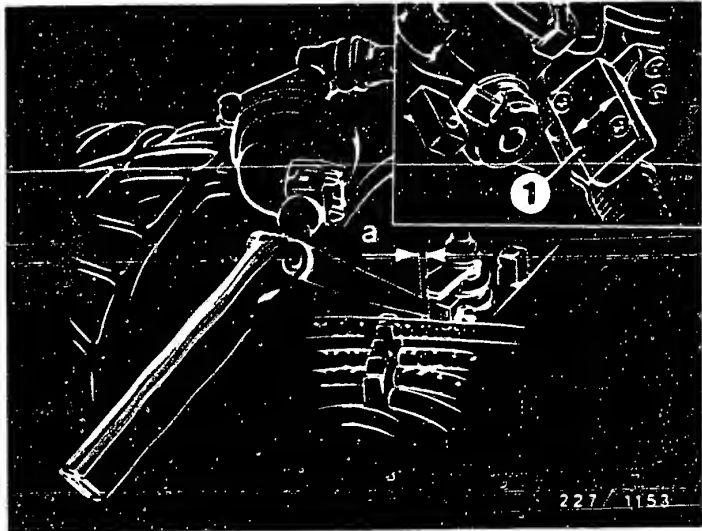
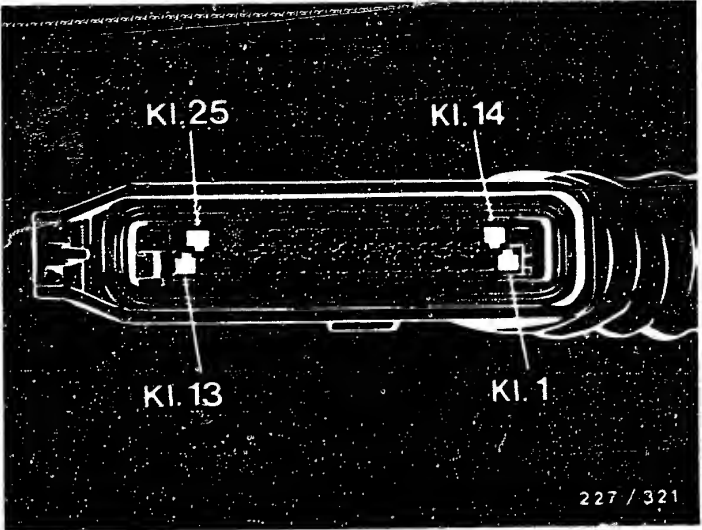
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For production reasons:  
continued on the following  
coordinate.



SELF-DIAGNOSIS TEST TABLE

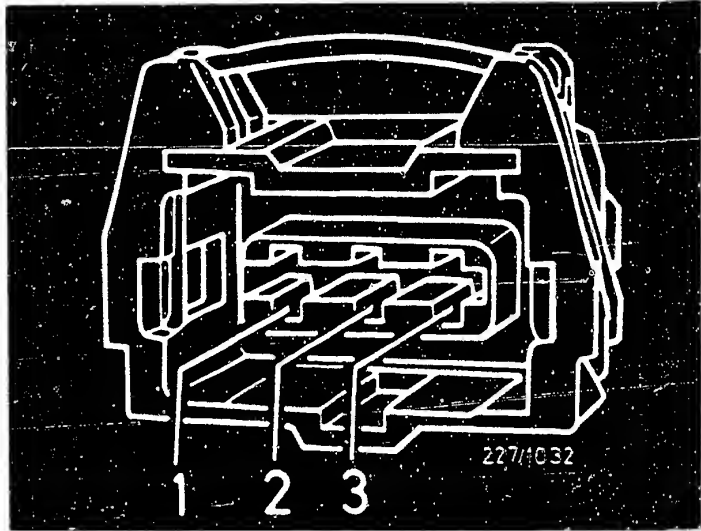
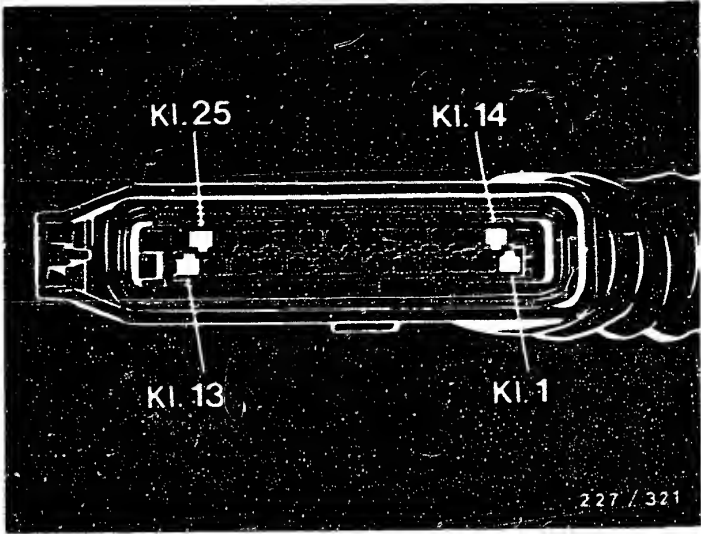
Fault indication Flashing code	Testing of component/function Test instructions/conditions	Termi- nals	Set values
1 1 1 1	EI-K CONTROL UNIT  Replace EI-K control unit.	—	—
2 1 2 1	THROTTLE-VALVE SWITCH - IDLE  Voltage, EI-K control-unit plug. Upper illustration. Check cut-in point: Ignition ON. Throttle-valve open. Slowly close throttle valve. Insert feeler gauge between throttle- valve stop and adjusting screw. Cut-in point 0,15...0,5 mm for idle stop. See center illustration, arrow (a = 0,15...0,5 mm, 1 = switch).	7 20 (+) (-)	0 V  Approx. battery voltage
2 1 2 3	THROTTLE-VALVE SWITCH - FULL LOAD  Voltage, EI-K control-unit plug. Throttle valve in idle position. Ignition ON. Secure pointer of protractor to throttle support bracket with rubber band. Screw graduated disc on to throttle valve stage 1. Push throttle-valve lever to full-load stop and set graduated disc to 0°. Cut-in point 6°...14° before full- load stop.	9 20 (+) (-)	0 V  Approx. battery voltage





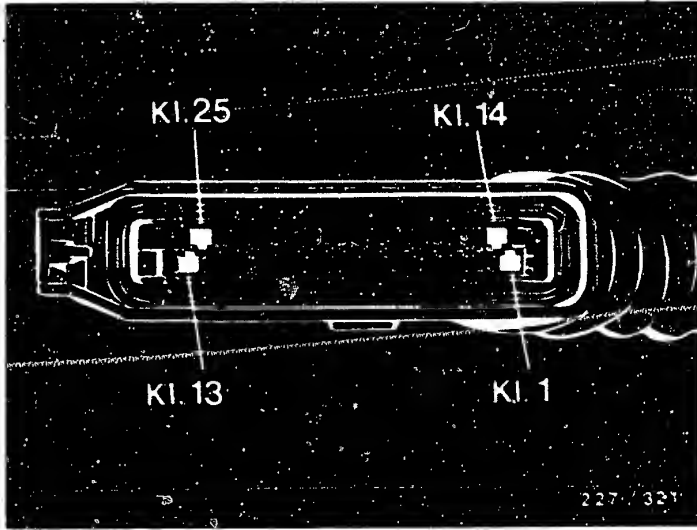
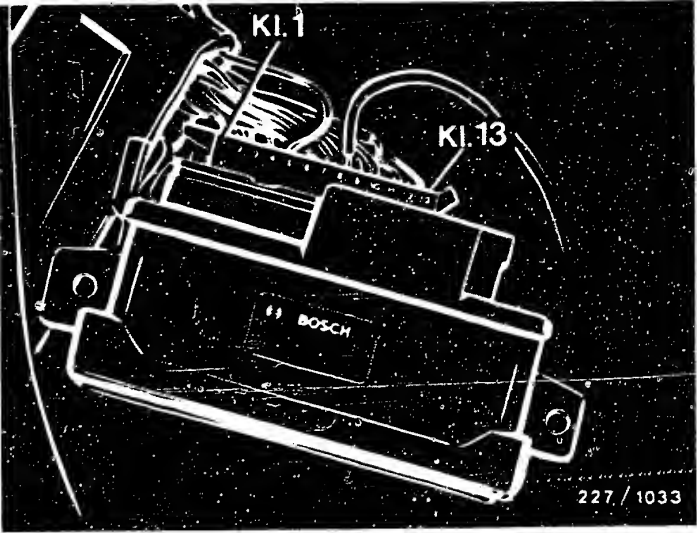
SELF-DIAGNOSIS TEST TABLE (Continued)

Fault display Flash code	Testing of component/function Test instructions/conditions	Term.	Set values
2 1 4 1	MAXIMUM RETARDATION OF KNOCK CONTROL  Fuel with insufficient octane number, Check ignition-point adjustment, fuel- injection. Bearing damage, abnormal engine noises.	—	—
2 1 4 2	KNOCK SENSOR  Resistance of EI-K control-unit plug (upper illustration) and knock-sensor plug connection (center illustration).  Resistance of knock-sensor plug connec. See center illustration. Tightening torque. See lower ill., arrow.	13 1 12 2 12 3 1 2	approx. 0 Ω approx. 0 Ω approx. 0 Ω infinite Ω  15–25 Nm
2 2 2 3	ALTITUDE SENSOR  Voltage of EI-K control-unit plug. See upper illustration. Ignition ON.	2 20 (+) (–)	Sea level = 3,2...4,7V 500 m = 2,8...4,0V 1000m = 2,4...3,5V 1500m = 2,0...3,0V 2000m = 1,5...2,5V 3000m = 0,8...1,6V



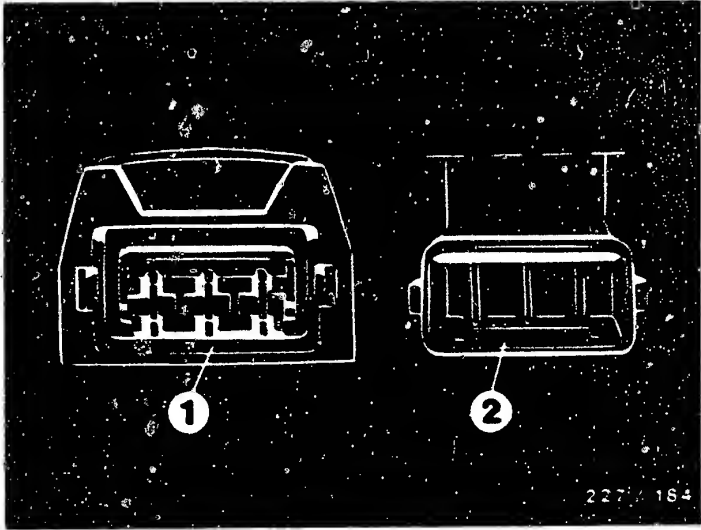
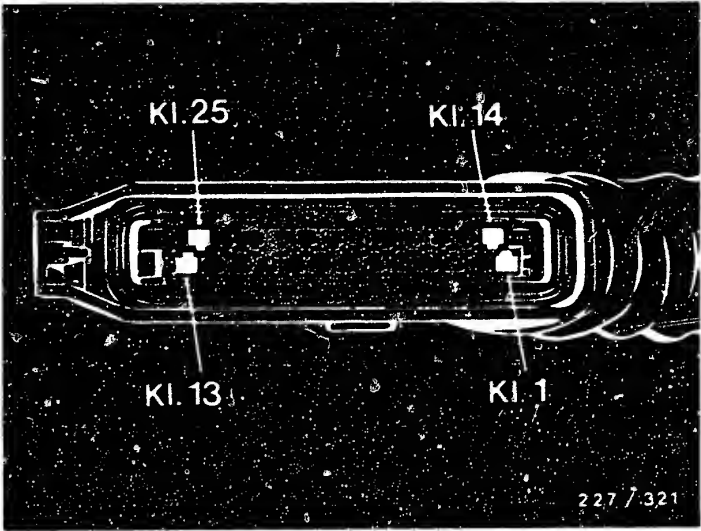
SELF-DIAGNOSIS TEST TABLE (Continued)

Fault display Flash code	Testing of component/function Test instructions/conditions	Term.	Set values
2 2 3 2	LOAD SIGNAL  Voltage, EI-K control-unit plug with handle cover removed. See upper illustration. Engine at idle.	8 20 (+) (-)	0,2...4,6 V
2 2 3 3	REFERENCE VOLTAGE FOR LOAD- AND ALTITUDE-SENSOR SIGNAL  Voltage, EI-K control-unit plug. See lower illustration. Ignition ON.	21 20 (+) (-)	4,5...5,1 V
2 3 1 2	TEMPERATURE SENSOR - COOLANT  Resistance of EI-K control-unit plug. See lower illustration.	25 20	+ 20°C=2,1...2,9k Ω + 30°C=1,4...2,0k Ω + 80°C=280...300 Ω + 90°C=210...280 Ω +100°C=160...210 Ω
4 4 4 4	NO FAULT IN MEMORY	—	—
0 0 0 0	END OF FAULT OUTPUT	—	—



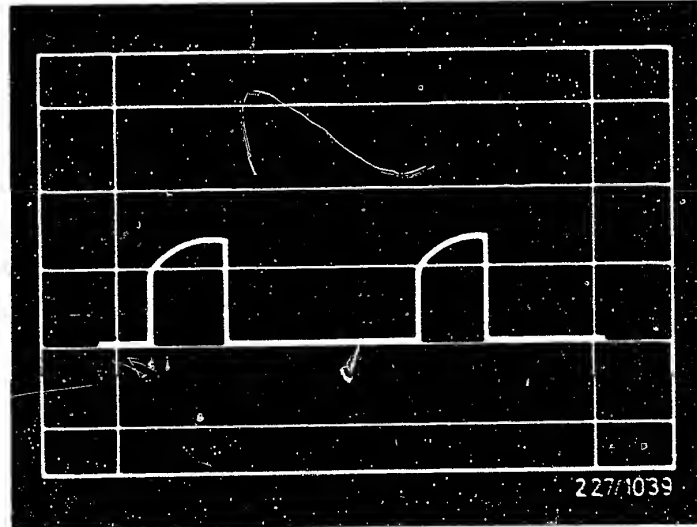
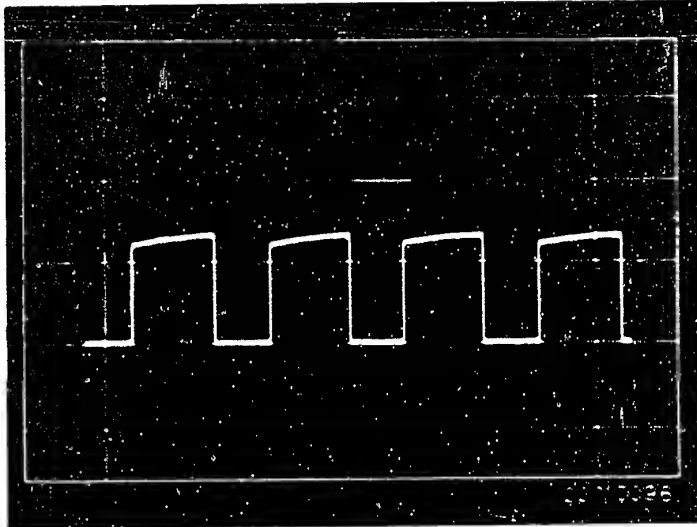
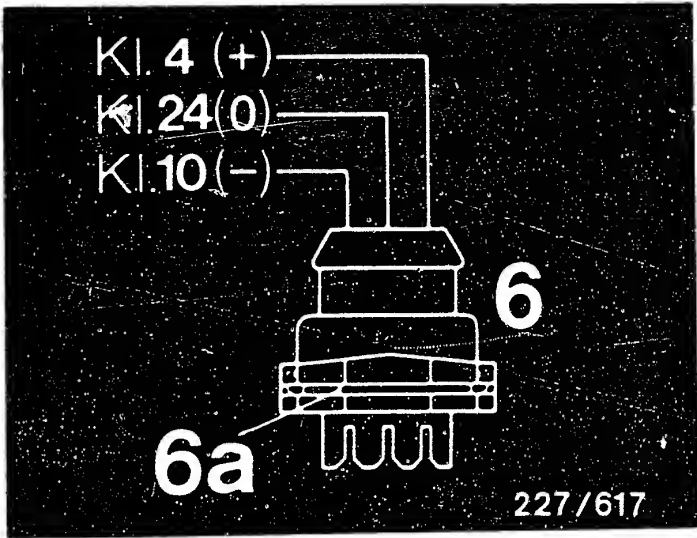
RAPID DIAGNOSIS CHART

Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
1	HIGH-VOLTAGE SIDE Test for example spark plugs, ignition harness, distributor cap etc. for proper functioning (e.g. open circuit, shunt). Assessment for example by ignition oscillogram, resistance measurement, visual examination.	—	—
2	IGNITION COIL Visual examination (Bosch only): plug fitted, sealing compound escaped? Resistance, primary (Bosch) Resistance, primary (non-Bosch) Resistance, secondary (Bosch) Resistance, secondary (non-Bosch)	—  1 15 1 15 1 4 1 4	—  0,6... 1,0 Ω 0,5... 1,5 Ω 6,4... 11,1 k Ω 5,0... 9,0 k Ω
3	VOLTAGE SUPPLY, EI-K CONTROL UNIT Disconnect EI-K control-unit plug. Ignition ON. Voltage, EI-K control-unit plug. See upper illustration. * If term. 22 present	  6 20 (+) (-) 6 *22 (+) (-)	  Battery voltage Battery voltage
4	IGNITION-DISTRIBUTOR PLUG AND SOCKET Disconnect ignition-distributor plug. Visual examination: check ignition-distributor plug and socket for oxidation. See lower illustration.	—	—



RAPID DIAGNOSIS CHART (continued)

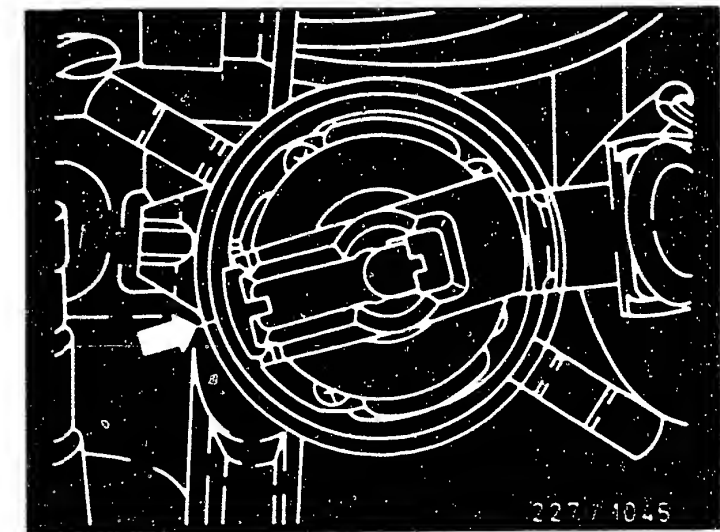
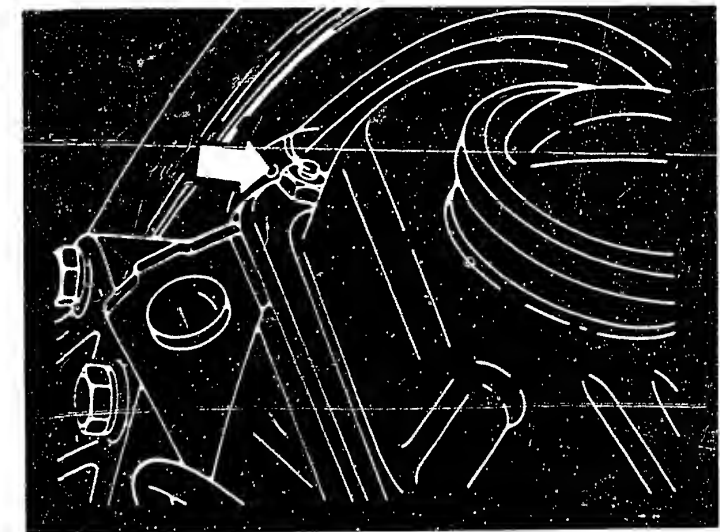
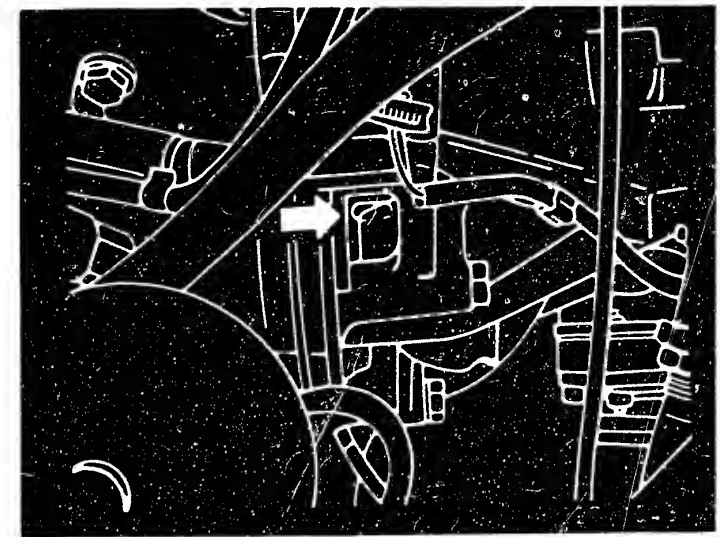
Test step	Testing of component/function Test instructions/conditions	Term.	Set values
5	VOLTAGE SUPPLY, MAGNETIC PULSE GENERATOR Connect ignition distributor and EI-K control-unit plugs. Ignition ON. Voltage, ignition-distributor plug. See upper illustration.	4 10 (+) (-)	equals/above 10 V
6	MAGNETIC PULSE GENERATOR - FUNCTION Start engine. "Special" oscilloscope to ig.-distributor plug. See upper illustration.	24 B- (+) (-)	Rectang. pulse (centre illus.)
7	EI-K CONTROL-UNIT - FUNCTION Trigger-box, ignition-distributor, and EI-K control-unit plugs connected. Start engine. "Special" oscilloscope to trigger-box plug.	2 B- (+) (-)	Rectang. pulse (lower illus.)
8	VOLTAGE SUPPLY, TRIGGER BOX Disconnect trigger-box plug. Ignition ON. Voltage, trigger-box plug.	1 3 (+) (-)	Battery voltage



RAPID DIAGNOSIS CHART (Continued)

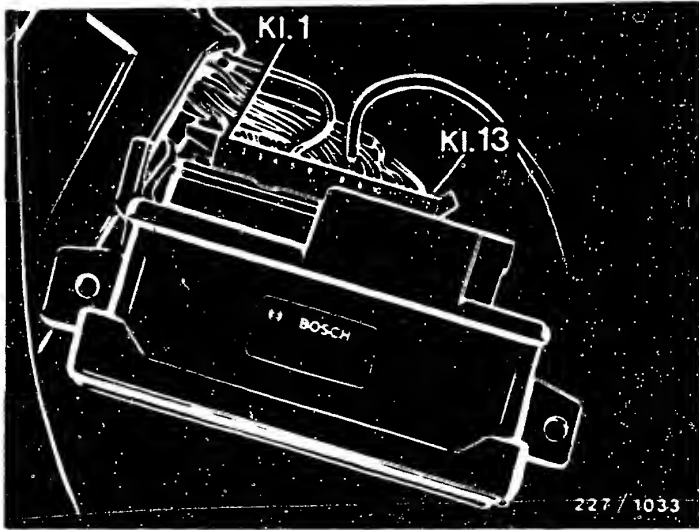
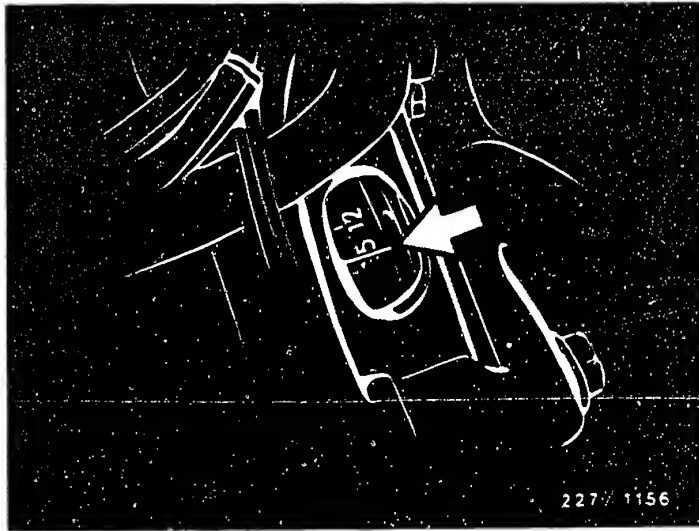
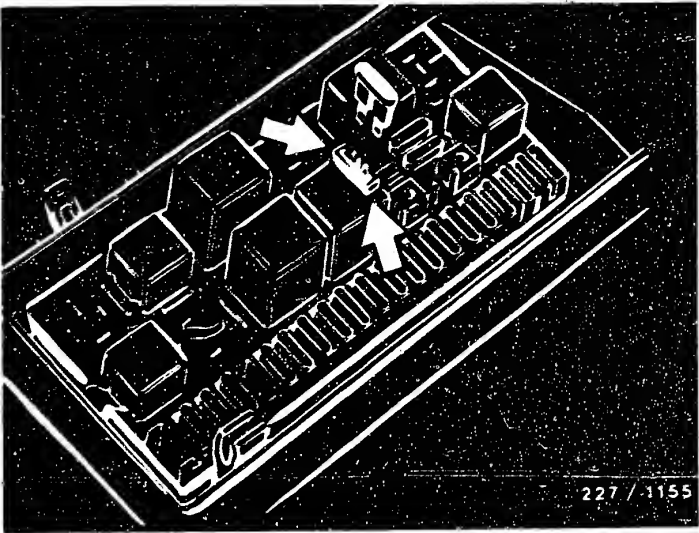
Test step	Testing of component/function Test instructions/conditions	Term.	Set values
9	PRIMARY SIGNAL EI-K control-unit, trigger-box, and ignition-distributor plugs connected. Start engine. Oscilloscope/engine-speed tester to ign. coil.	15 1 (+) (-)	Primary voltage - engine-speed display (level unimportant)
10	TRIGGERING, ELECTRIC FUEL PUMP RELAY Ignition ON. The electric fuel pump relay including the electric fuel pump are triggered (can be heard).	—	Triggering approx. 1 second
11*	CONTACT RESISTANCES Check trigger-box voltage supply leads or primary circuit for contact resistance.	various	max.0,5 Ω
12*	IGNITION-DISTRIBUTOR INSTALLATION SETTING Engine cyl. 1 at TDC. Upper illustration. Camshaft marking aligns with upper edge of valve-cover seal. Center illustration. Middle of distributor rotor points to housing marking. Lower illustration.	—	—
13	FAULT LAMP Ignition ON. Engine at idle.	— —	Fault lamp lights up Fault lamp OFF

\* carry out only when engine not running.



RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
14	<b>BASIC IGNITION SETTING</b> Engine-oil temperature at least 80° °C Throttle-valve idle position. Air conditioner switched off. Fault lamp must not flash. Bridge contact at electric-fuel-pump relay with fuse. See upper illustration, arrow. Engine at idle. Note: Setting $15 \pm 1^\circ$ before TDC. See center illustration, arrow.	—	13...17° before TDC
15	<b>VOLTAGE SUPPLY, EI-K CONTROL UNIT</b> Voltage, EI-K control-unit plug with handle cover removed. See lower illustration. Engine at idle.	6 20 (+) (-)	12 - 14 V Max. 2 V below battery +ve
16	<b>VOLTAGE SUPPLY, IGNITION COIL</b> Engine at idle. Voltage, ignition coil and battery.	15 B- (+) (-)	Equal to/greater than 10 V



# TEST SPECIFICATIONS

Idle throttle-valve switch with ignition ON Open throttle valve	0 V
Feeler gauge between throttle-valve stop	0,15...0,5 mm Approx. battery voltage
Full-load throttle-valve switch with ignition ON in idle position Throttle valve	0 V 6°...14° before full-throttle stop Approx. battery voltage
Knock sensor Tightening torque	15...25 Nm
Altitude sensor Sea level	3,2...4,7 V
500 m	2,8...4,0 V
1000 m	2,4...3,5 V
1500 m	2,0...3,0 V
2000 m	1,5...2,5 V
3000 m	0,8...1,6 V
Load signal with engine at idle	0,2...4,6 V

# TEST SPECIFICATIONS (Continued)

Reference voltage for load and altitude sensors with ignition ON	4,5...5,1 V
Temperature sensor - coolant	+20°C 2,1...2,9k Ω +30°C 1,4...2,0k Ω +80°C 280...370 Ω +90°C 210...280 Ω +100°C 160...210 Ω
Ignition coil primary (Bosch)	0,6... 1,0 Ω
primary (non-Bosch)	0,5... 1,5 Ω
secondary (Bosch)	6,4...11,1 k Ω
secondary (non-Bosch)	5,0... 9,0 k Ω
Voltage supply, EI-K control unit with ignition ON	Battery voltage
Voltage supply, magnet pulse generator with ignition ON	Equals/above 10 V
Magnet pulse generator functioning at cranking speed	Rectangular pulse



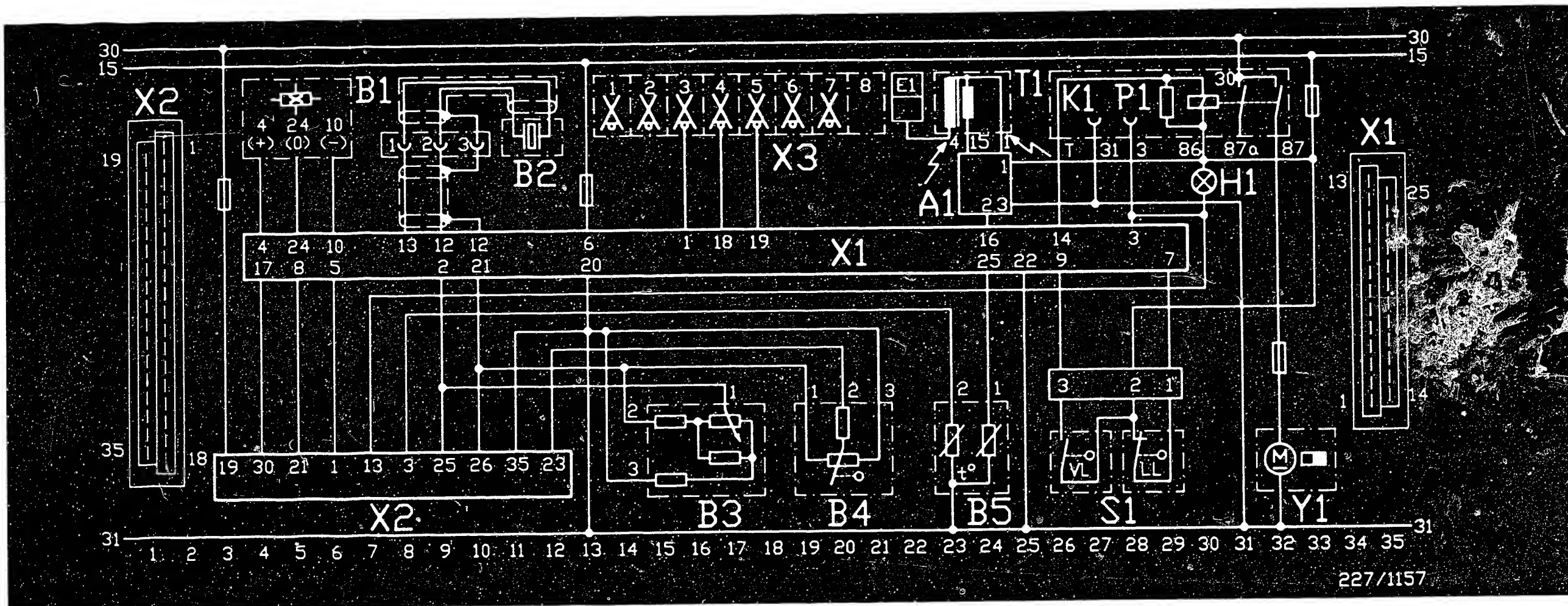
## TEST SPECIFICATIONS (continued)

EI-K control unit functioning at cranking speed	Rectangular pulse
Voltage supply, trigger box with ignition ON	Battery voltage
Primary signal at cranking speed	Primary voltage/ engine-speed display
Triggering of electric fuel pump relay with ignition ON	Approx. 1 second (acoustic)
Contact resistance	max.0,5 $\Omega$
Supply leads, trigger box or primary circuit	
Ignition-distributor installation setting	Cyl.1 at TDC Igtn.-dist. marking
Fault lamp Ignition ON with engine idling	ON OFF

## TEST SPECIFICATIONS (continued)

Basic ignition setting	
Electrical fuel pump relay bridged	
Engine idling	13...17° before TDC (Setting value 15 $\pm$ 1°)
Voltage supply, EI-K control unit Engine idling	12 - 14 V max.2 V below battery voltage
Voltage supply, ignition coil Engine idling	equals/above 10 V

For setting values for idle speed, exhaust,  
valve play, etc. see the Jetronic SIS  
microcard or Autodata test specifications.



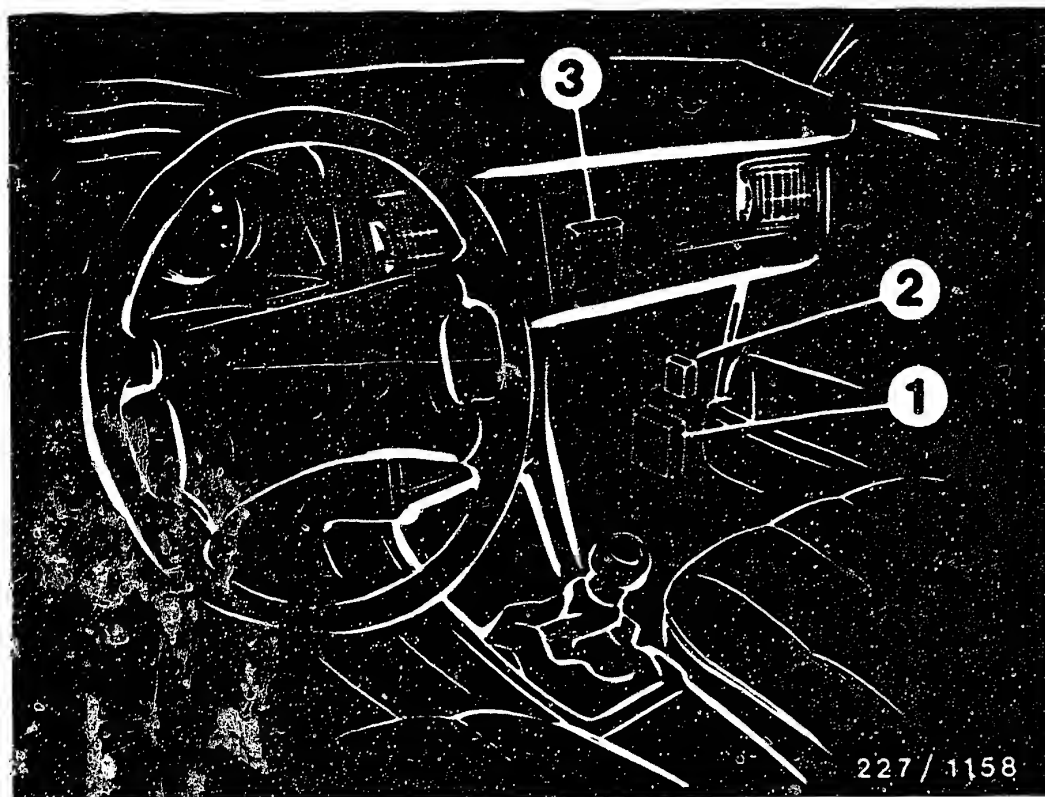
# ELECTRICAL TERMINAL DIAGRAM

High-voltage arrows: Danger 400 V...25 kV

A1= Trigger box  
A2= KE-Jetronic control unit  
B1= Magnetic pulse generator  
B2= Knock sensor  
B3= Temperature sensor - coolant  
B4= Air-flow sensor (Pot.)  
B5= Altitude sensor

E1= To ignition distributor  
H1= Fault lamp  
K1= Electric fuel pump relay  
P1= Contacts for diagnosis  
S1= Throttle-valve switch idle/full load

T1= Ignition coil  
X1= EI-K control-unit plug  
X2= Encoding plug  
Y1= Electric fuel pump



- 1 = EI-K control unit  
2 = Altitude sensor  
3 = KE-Jetronic control unit

#### INSTALLATION POSITION OF COMPONENTS

- \* EI-K control unit:  
in the footwell on the passenger's side (see illus.).
- \* Altitude sensor:  
in the footwell on the passenger's side above  
the EI-K control unit (see illustration).
- \* KE-Jetronic control unit:  
in the footwell on the passenger's side (see illus.).
- \* Variant encoding (if fitted):  
in the EI-K control unit.

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- \* Temperature sensor (engine):  
near to the spark plug of cyl. 1.
- \* Throttle-valve switch (idle/full load):  
on the throttle-valve assembly.
- \* Trigger box with ignition coil:  
next to the battery.
- \* Knock sensor:  
near to the left-hand engine mounting.
- \* Electric-fuel-pump relay:  
in the central electrics.
- \* Fault lamp:  
in the instrument cluster.

Trouble-shooting instructions : MB-5034

BOSCH system : Automatic heating and air-conditioning system (Tempmatik)

Make of vehicle : MERCEDES-BENZ

Basic microcard : MB-513

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SPECIAL FEATURES

This microcard contains the trouble-shooting instructions for the electronic automatic heater and air conditioner (Tempmatic) in the following vehicles:

MERCEDES-BENZ Type W 126: 260 SE...560 SEL (9.87 ->)

Type C 126: 420 SEC...560 SEC (9.87 ->)

- \* As of 9.87, the control unit of the Tempmatic has been equipped with self-diagnosis and the range of functions has been extended.
- \* A separate temperature sensor has been installed in the systems for measuring the engine temperature.
- \* In addition, an ambient-temperature sensor has been installed to improve control of the discharge temperature.
- \* Activation of the auxiliary fan (Speed 2) and of the fresh-air/circulation-air flap has been integrated into the air-conditioner control unit.
- \* The electropneumatic fresh-air/circulation-air switch has been replaced by an electric switch.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/ component faults.  
For detailed instructions for trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, trigger boxes and control units or to the ignition system, be sure to observe the information in the basic instructions.

CAUTION!  
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1.	No or poor heating effect
2.	No or poor cooling effect
3.	Heating blower cannot be regulated
4.	Incorrect air distribution
5.	Circulatory operation not possible
6.	Auxiliary fan is not switched in
7.	Idling problems when switching in the refrigerant compressor
Cause (component fault)	
*	Evaluated self-diagnosis
*	Coolant level too low
*	Check refrigerant level
*	Drier defective
*	Capacitor dirty
*	Auxiliary heating-water pump mechanically defective
*	Heating-water valve mechanically defective
*	* Check control unit of compressor cutoff
*	Check TD signal to control unit of compressor cutoff
*	Check speed sensor of refrigerant compressor
*	Pressure switch defective
	* Pressure switch of auxiliary fan defective
*	Check magnetic clutch of refrigerant compressor
*	Refrigerant compressor mechanically defective

## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. No or poor heating effect
2. No or poor cooling effect
3. Heating blower cannot be regulated
4. Incorrect air distribution
5. Circulatory operation not possible
6. Auxiliary fan is not switched in
7. Idling problems on switching in the refrigerant compressor

Cause (component fault)						
*		*				Check blower switch
*		*				Series-resistor group of blower motor defective
*		*				Blower motor defective
	*			*		Auxiliary fan open-circuited or mechanically defective
	*			*		Check series resistor of auxiliary fan
*	*		*			Adjusting flaps mechanically defective
				*		Change-over valves open-circuited or mechanically defective
				*		Check switch of fresh-air flap/circulating-air flap
*	*		*	*	*	Check vacuum system
*	*					Check sensor-type blower
*	*			*	*	Control unit defective
*	*					Check temperature-selection thumbwheels
	*					Check air-conditioner switch
					*	Check activation lead to KE-Jetronic

For production reasons:  
continued on the following  
coordinate.

## HOW TO USE THE SELF-DIAGNOSIS AND SELF-DIAGNOSIS TEST TABLE

Installed in this vehicle is a control unit which has a self-diagnosis facility. Therefore, trouble-shooting must always be started with self-diagnosis.

The indicated faults in the automatic heater and automatic air conditioner are broken down in the self-diagnosis test table. The self-diagnosis test table contains fault indication, component tested, test terminals at control-unit plugs, causes of trouble, test instructions and set values.

The trouble-shooting chart should be used only if a customer complaint has been received and there is no fault stored in the fault memory. Listed in the trouble-shooting charts are only those components which are not tested by the self-diagnosis facility.

### Activating the self-diagnosis:

Position the temperature-selection thumbwheels to the center position (approx. 22°C). Connect sockets 2 and 4 of the flashing-code evaluation unit KDAW 9980 to socket 7 of the test coupling for diagnosis (upper illustration).

Connect evaluation unit socket 1 to battery +ve and socket 3 to ground (socket 1 of diagnostic coupling).

Switch on ignition. Press push-button on evaluation unit for approx. 1 s. Output of the self-diagnosis begins approx. 2 s. after stimulation with the first flashing code. Each flashing code consists of a flashing-pulse block with 1 to 57 flashing pulses.

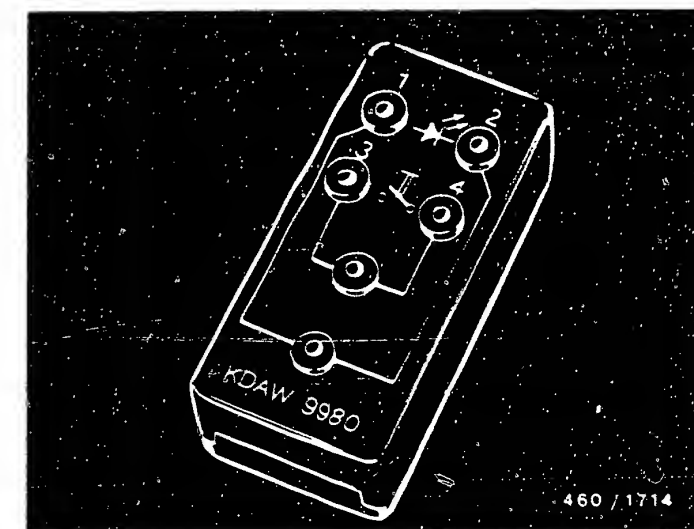
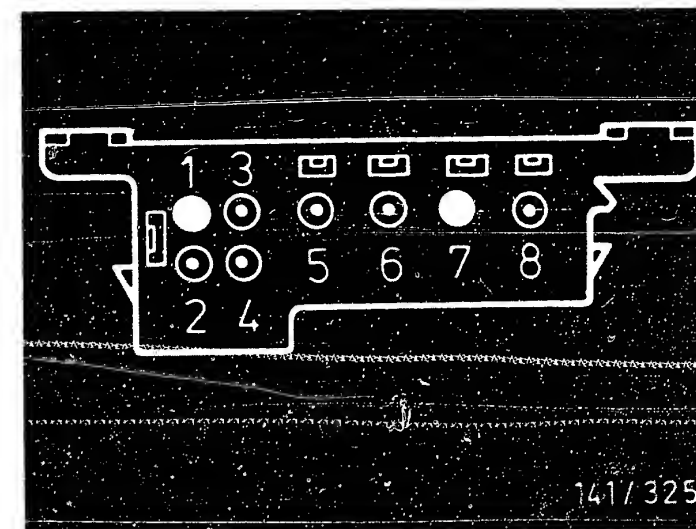
### Continuing diagnosis:

After a fault has been read out, the next fault is output by pressing the push-button again. Continue diagnosis until the fault output first of all is repeated. Diagnosis output can be ended only by switching off the ignition.

### Note:

During diagnosis output, the LED in the fresh-air/circulation-air switch flashes.

If the control unit cannot be stimulated into outputting diagnosis, check whether the voltage supply of the control unit and the diagnostic lead from control unit term. 15 to the diagnostic test coupling socket 7 is open-circuited.





SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/test conditions	Terminals	Set values
1	Control unit and peripherals	No system fault.	—	—
3	Open-circuit in passenger-compartment temperature sensor	Test resistance of passenger-compartment temperature sensor: at 10°C:	15 13	Approx. 18,3...21,5 k Ω
2	Short-circuit in passenger-compartment temperature sensor	at 45°C: Test leads for short-circuit and open-circuit.	15 13	Approx. 3,5...4,5 k Ω
5	Open-circuit in ambient-temperature sensor	Test resistance of ambient-temperature sensor: at 10°C:	16 13	Approx. 5,0...6,0 k Ω
4	Short-circuit in ambient-temperature sensor	at 45°C: Test leads for short-circuit and open-circuit.	16 13	Approx. 1,1...1,3 k Ω
7	Open-circuit in evaporator-temperature sensor	Test resistance of evaporator-temperature sensor: at 0°C:	1 13	Approx. 30,0...35,0 k Ω
6	Short-circuit in evaporator-temperature sensor	at 45°C:	1 13	Approx. 3,5...4,5 k Ω
9	Open-circuit in discharge-temperature sensor, left	Test resistance of discharge-temperature sensor, left: at 10°C:	17 13	Approx. 18,3...21,5 k Ω
8	Short-circuit in discharge-temperature sensor, left	at 45°C: Test leads for short-circuit and open-circuit.	17 13	Approx. 3,5...4,5 k Ω

## SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/test conditions	Terminals	Set values
11	Open-circuit in discharge-temperature sensor, right	Test resistance of discharge-temperature sensor, right:  at 10°C:  at 45°C:  Test leads for short-circuit and open-circuit.	18 13	Approx. 18,3...21,5 k $\Omega$
10	Short-circuit in discharge-temperature sensor, right		18 13	Approx. 3,5...4,5 k $\Omega$
13	Open-circuit in cooling-water temperature sensor	Test resistance of temperature sensor (cooling water):  at 20°C:  at 100°C:  Test leads for short-circuit and open-circuit.	2 13	5,0...8,0 k $\Omega$
12	Short-circuit in cooling-water temperature sensor		2 13	300...400 $\Omega$
30	Short-circuit or open-circuit in auxiliary heating-water pump	Switch on ignition. Test supply voltage for auxiliary heating-water pump: Test leads for short-circuit and open-circuit. (Press button "DEF". Heating-water pump must function).	3 12	Greater than 10 V
31	Short-circuit or open-circuit in duo heating-water valve, left	Switch on ignition. Test supply voltage for heating-water valve, left:  Test leads for short-circuit and open-circuit.	4 12	Greater than 10 V
32	Short-circuit or open-circuit in duo heating-water valve, right	Switch on ignition. Test supply voltage for heating-water valve, right:  Test leads for short-circuit and open-circuit.	5 12	Greater than 10 V
33	Short-circuit in control unit for compressor cutoff	Switch on ignition. Test supply voltage for compressor cutoff unit: (Note: output signal can only be tested with compressor cutoff unit connected). Test contacts of compressor cutoff unit (corrosion or lead come off). Test leads for short-circuit and open-circuit.	6 12	Greater than 10 V

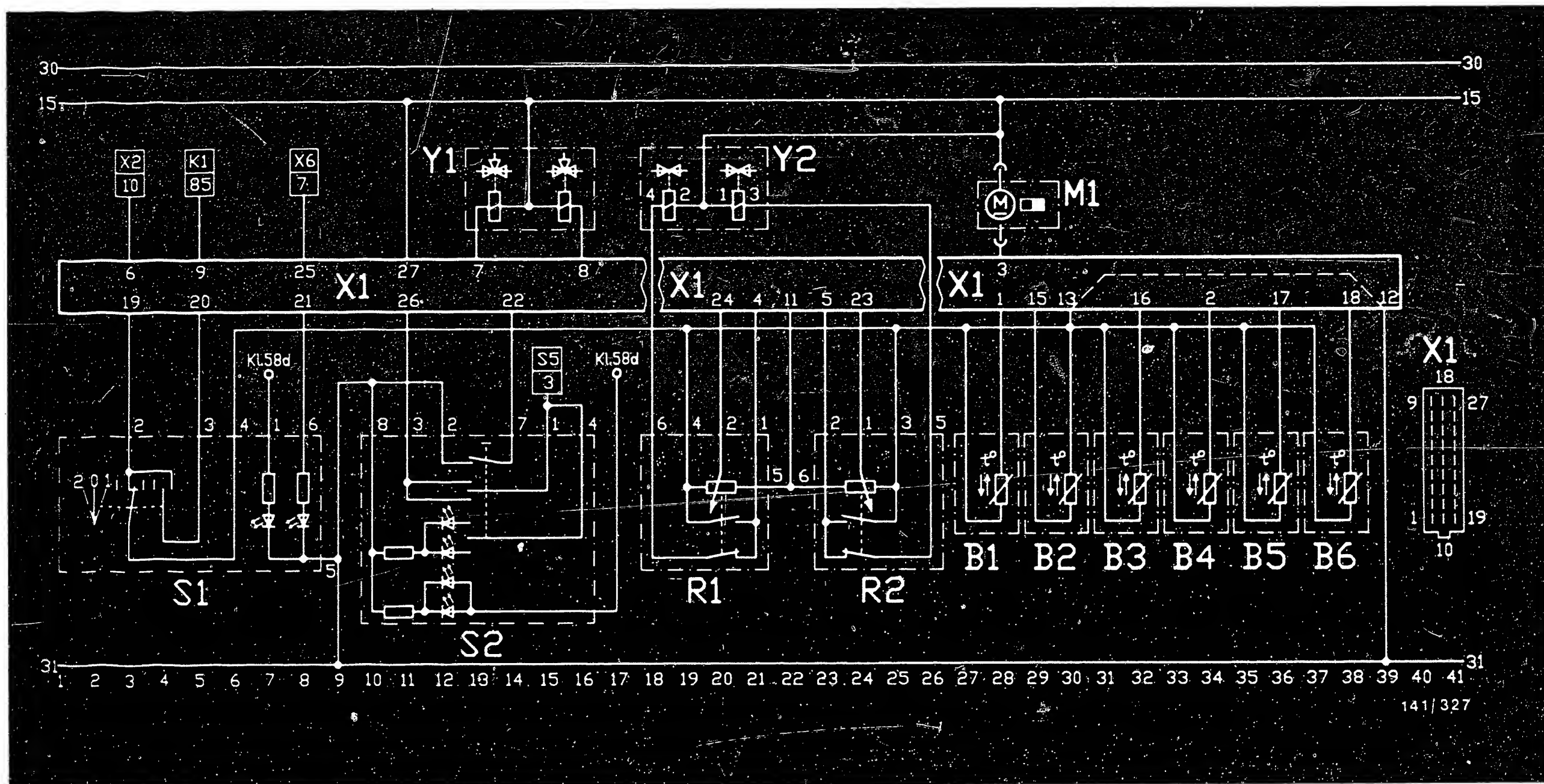
SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
34	Short-circuit or open-circuit in auxiliary fan	Switch on ignition. Test supply voltage for relay of auxiliary fan: Test leads for short-circuit and open-circuit.	9 12	Greater than 10 V
56	Change-over valve Long-stroke recirculating-air flap, short-circuit or open-circuit	Switch on ignition. Test supply voltage of change-over valve:  Test leads for short-circuit and open-circuit.	8 12	Greater than 10 V
57	Change-over valve Short-stroke recirculating-air flap, short-circuit or open-circuit	Switch on ignition. Test voltage supply of change-over valve:  Test leads for short-circuit and open-circuit.	7 12	Greater than 10 V

TEST SPECIFICATIONS

Passenger-compartment temperature sensor	<u>Internal resistance</u>	
	21,5...3,5 k $\Omega$	at 10...45°C
	21,5...3,5 k $\Omega$	at 10...45°C
	35,0...3,5 k $\Omega$	at 0...45°C
	6,0...1,1 k $\Omega$	at 10...45°C
Temperature selector, total resistance	approx. 9,5...10,5 k $\Omega$	
Heating-water valve	approx. 10...20 $\Omega$	
Heating-water-pump power consumption	max. 1 A	
Coolant-temperature sensor	8,0 k $\Omega$ ...300 $\Omega$	at 20...100°C
Change-over-valves internal resistance	approx. 50...80 $\Omega$	
Low-pressure switch, compressor	<u>Switching points</u>	
	"Off" at 2,0 bar	"On" at 2,6 bar
	"Off" at 30 bar	"On" at 22 bar
	"Off" at 15 bar	"On" at 20 bar
	"On" at 20 bar	

For production reasons:  
continued on the following  
coordinate.



# ELECTRICAL TERMINAL DIAGRAM - TEMPMATIC

X1 = Plug, Tempmatic control unit (term. 12 and term. 13 in ECU connected)

X5 = Diagnostic-test coupling

S1 = Switch, fresh-air/circulating-air flap

S2 = Switch, air conditioner

B1 = Evaporator-temperature sensor

B2 = Passenger-compartment temp. sensor

B4 = Temperature sensor (engine)

B3 = Ambient-temperature sensor

B5 = Discharge-temperature sensor, left

B6 = Discharge-temperature sensor, right

M1 = Heating-water pump

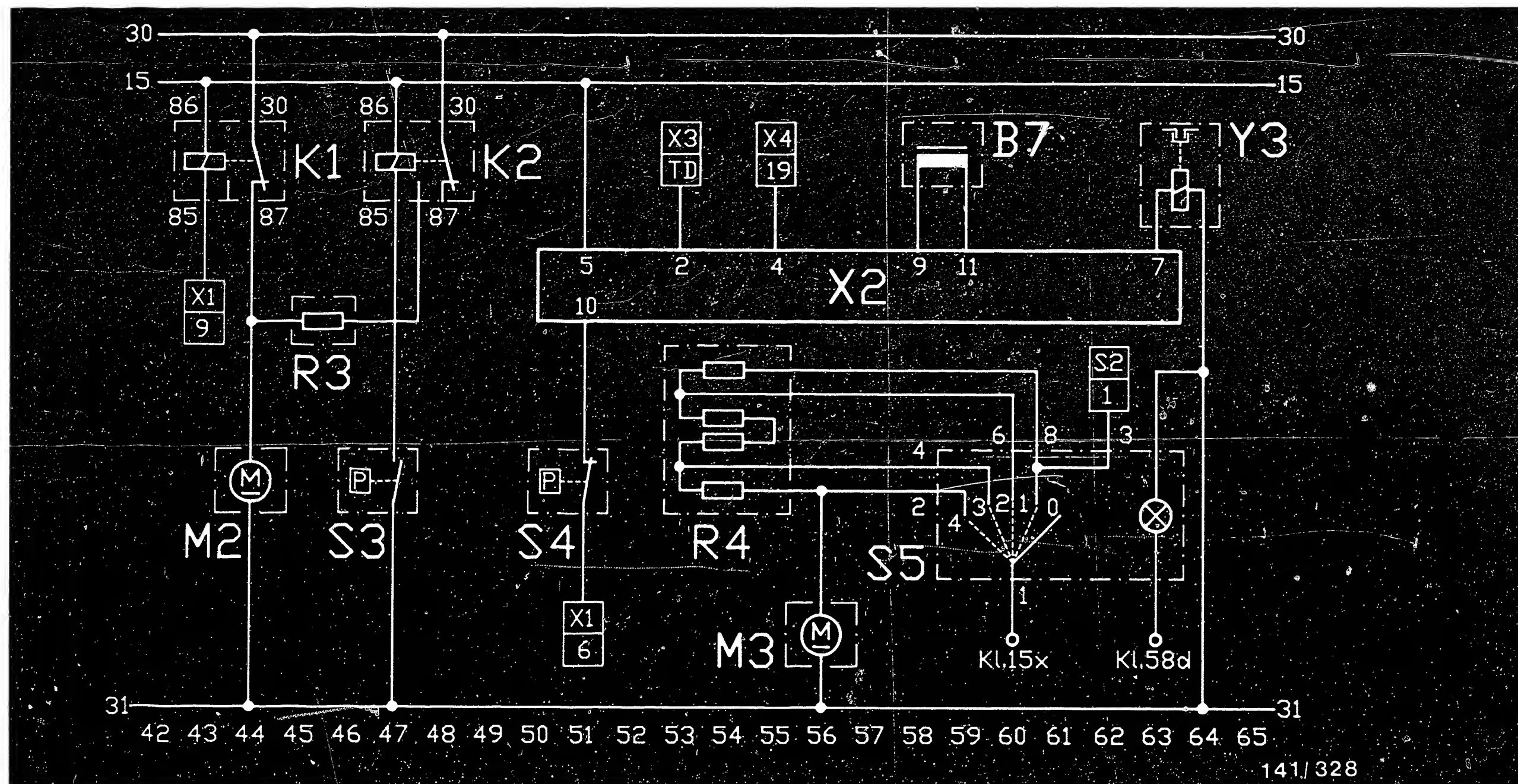
R1 = Set-value adjuster, left

R2 = Set value adjuster, right

K1 = Relay, Speed 2 of auxiliary fan

Y1 = Change-over valve, fresh-air/circulating-air flap

Y2 = Duo heating-water valve

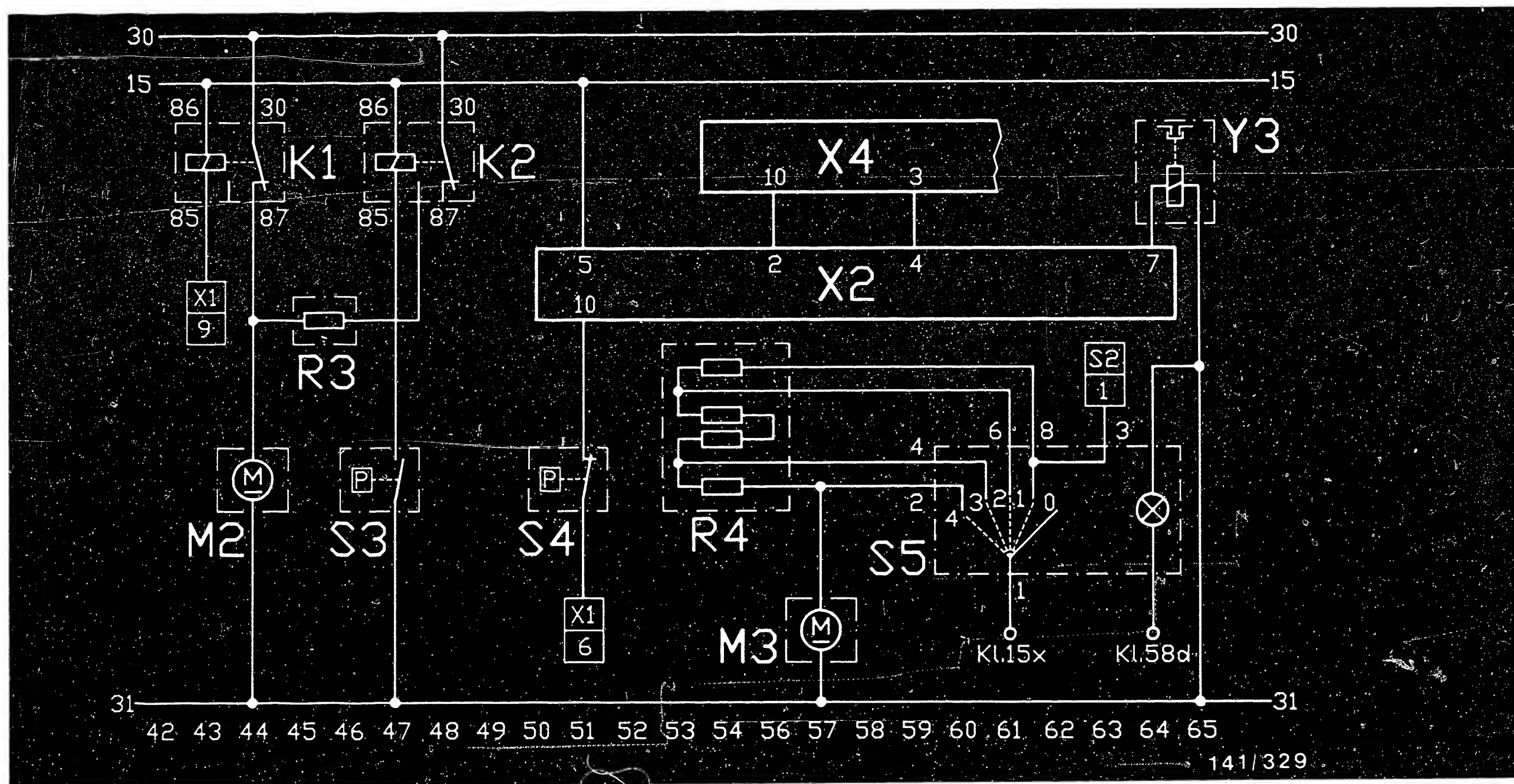


ELECTRICAL TERMINAL DIAGRAM - TEMPMATIC (Continued for 6-cyl. engine)

X2 = Plug, control unit of  
compressor cutoff  
X3 = Plug, EI control unit  
X4 = Plug, KE-Jetronic control unit  
Y3 = Magnetic clutch, refrigerant compressor  
M2 = Auxiliary fan  
M3 = Blower motor

R3 = Series resistor, auxiliary fan  
R4 = Series-resistor group, blower  
S3 = Pressure switch, auxiliary fan  
S4 = Pressure switch, refrigerant compressor  
S5 = Air-flow switch  
K2 = Relay, Speed 1 of auxiliary fan  
B7 = Speed sensor, refrigerant compressor





ELECTRICAL TERMINAL DIAGRAM - TEMPMATIC (Continued for 8-cyl. engine)

X2 = Plug, control unit of  
compressor cutoff  
X4 = Plug, control unit of  
low-idle-speed control  
Y3 = Magnetic clutch, refrigerant compressor  
M2 = Auxiliary fan  
M3 = Blower motor

R3 = Series resistor, auxiliary fan  
R4 = Series-resistor group, blower  
S3 = Pressure switch, auxiliary fan  
S4 = Pressure switch, refrigerant compressor  
S5 = Air-flow switch  
K2 = Relay, Speed 1 of auxiliary fan



## INSTALLATION POSITION OF COMPONENTS

The test coupling for diagnostic output is installed in the engine compartment near to the battery.

The ambient-temperature sensor is installed in the air-intake opening next to the wiper motor.

The temperature sensor (engine) is installed in the hose fitting on the left-hand side (as seen in the forward direction of travel) next to the oil dipstick.

The installation positions of the remaining components have not changed compared with those given in the basic instructions.

For production reasons:  
continued on the following  
coordinate.

Trouble-shooting instructions : OPE-5007  
BOSCH system : VE..F..  
Make of vehicle : OPEL  
Basic microcard : PKW-075

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Section	Coordinates
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Trouble-shooting chart.....	03
Test specifications.....	07
Tightening torques.....	08
Electrical terminal diagram.....	09
Installation position of components.....	11

## SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following OPEL model:

OPEL Corsa Diesel  
1.5 l / 4-cylinder engine / 37 kW  
with distributor-type fuel-injection pump VE..F..

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty (when warm or cold)
2. Engine hunts when idling
3. Rough idling when engine is warm
4. Fuel consumption high, maximum engine power not reached, and smoke formation
5. Unsatisfactory performance
6. Black smoke in full-load range, engine running rough; possibly lack of power
7. Engine running rough

Cause (component fault)					
*	*			*	
Tank empty, tank breather					
*		*			
Injection sequence not firing order					
	*			*	
Inlet-union screws, inlet/return					
*					
Shutoff device					
	*			*	
Air in fuel system					
*					
Paraffin separation					
Fuel lines leaking					
*				*	
Fuel lines clogged					
*				*	
Supply lines clogged					
				*	
Engine air filter					
	*				
Idle speed					
*	*			*	*
Injection nozzle					
*					
Preheating system					

## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty (when warm or cold)
2. Engine hunts when idling
3. Rough idling when engine is warm
4. Fuel consumption high, maximum engine power not reached, and smoke formation
5. Unsatisfactory performance
6. Black smoke in full-load range, engine running rough; possible lack of power
7. Engine running rough

Cause (component fault)					
*				*	
Fuel filter					
				*	*
Timing device					
*		*			
Engine compression					
		*	*	*	*
Coordination, pump - engine (injection timing)					
		*	*	*	
Engine timing					

## TROUBLE-SHOOTING CHART (Continued)

Customer complaint (symptoms of trouble)

8. Engine misfiring during vehicle operation

9. Engine cannot be switched off

10. Incorrect engine speeds

11. Engine will not rev up when cold

12. High idle and engine running rough at high engine speed

13. Black smoke in full-load range

14. Fog-like smoke in full-load range (white)

Cause (component fault)

\* Tank empty, tank breather

\* Injection sequence not firing order

\* Inlet-union screws, inlet/return

\* \* Shutoff device

\* Air in the fuel system

\* Paraffin separation

\* Fuel lines leaking

\* Fuel lines clogged

\* Supply lines clogged

\* Engine air filter

\* Idle speed

## TROUBLE-SHOOTING CHART (Continued)

Customer complaint (symptoms of trouble)

8. Engine misfiring during vehicle operation

9. Engine cannot be switched off

10. Incorrect engine speeds

11. Engine will not rev up when cold

12. High idle and engine running rough at high engine speed

13. Black smoke in full-load range

14. Fog-like smoke in full-load range (white)

Cause (component fault)

\* Fuel filter

\* Timing device

\* Engine compression

\* \* Coordination, pump - engine (injection timing)

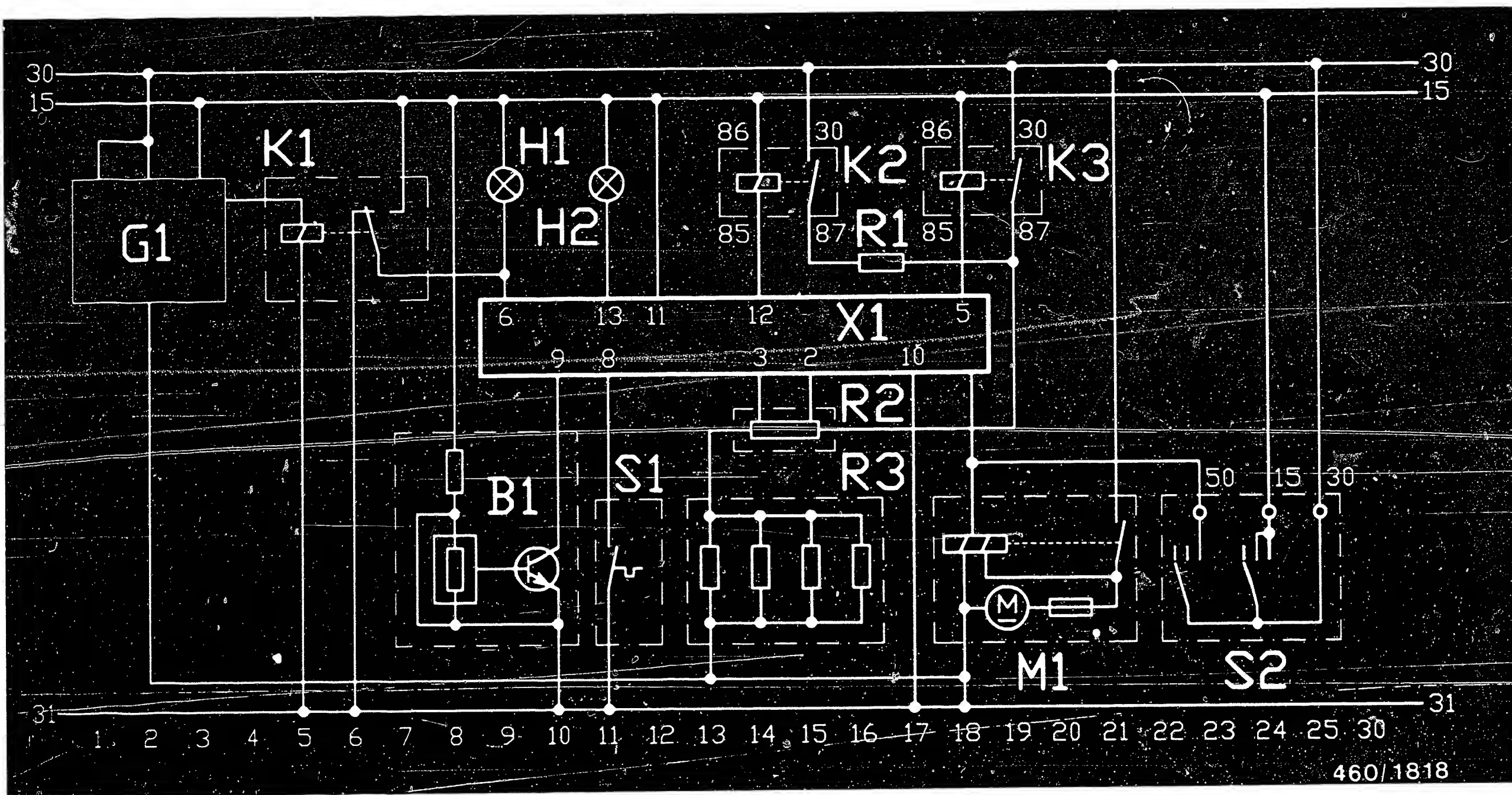
\* Engine timing

## TEST SPECIFICATIONS

Idle speed:	
* Engine warm:	780....840 min <sup>-1</sup>
* Engine cold:	950...1000 min <sup>-1</sup>
Nozzle-opening pressure:	152...162 bar
Coordination, pump - engine (injection timing):	
Setting:	
* Engine position at TDC:	1. cylinder
* Pump position after BDC:	0,90 mm
Check value:	
* Engine position at TDC:	1. cylinder
* Pump position after BDC:	0,85...0,95 mm
Compression:	22 bar
Max. difference between cylinders:	1 bar
Filter test	
* Max. permissible differential pressure:	0,3 bar

## TIGHTENING TORQUES

Fuel lines	25 Nm
Fastening screws / injection pump	25 Nm
Fastening screws / nozzle-holder assembly	50 Nm
Sheathed-element glow plugs	25 Nm
Screw plug	15 Nm
Nut / injection-pump gear	70 Nm
Tensioning torque for toothed-belt tensioning roller	25 Nm
Upper toothed-belt casing	10 Nm
Injection-pump holder	45 Nm
Air-filter housing	25 Nm
Nozzle return line	35 Nm

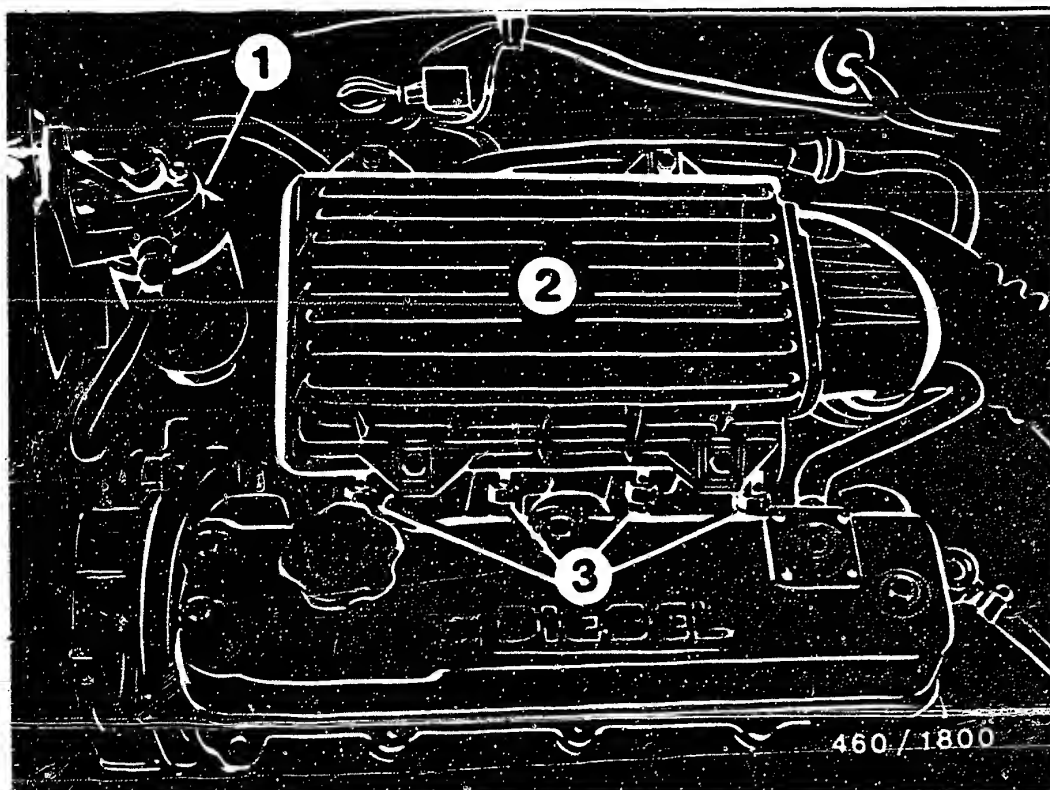


B1 = Sensor (distance travelled)  
 G1 = Alternator  
 H1 = Charge indicator pump  
 H2 = Preheating-indicator lamp  
 K1 = Relay (charge indicator lamp)  
 K2 = Relay (series resistor)

K3 = Relay (measuring resistor)  
 M1 = Starting motor  
 R1 = Series resistor  
 R2 = Measuring resistor  
 R3 = Sheathed-element glow plugs

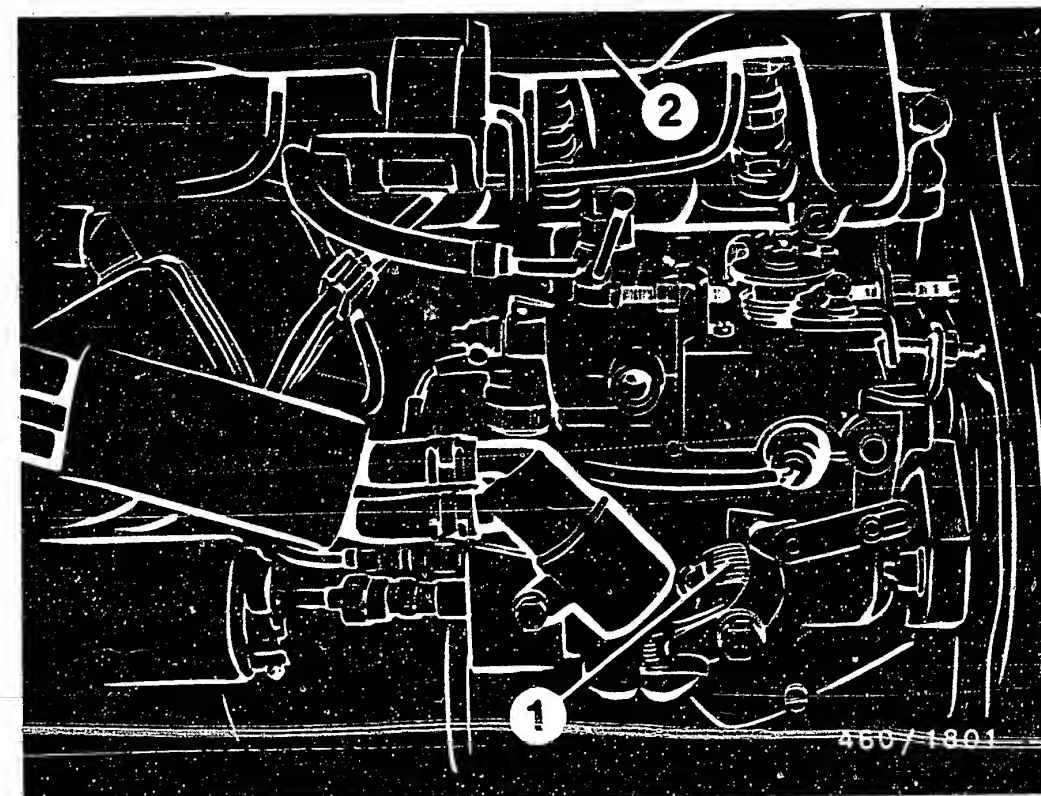
S1 = Switch, temperature sensor (engine)  
 S2 = Ignition and starting switch  
 X1 = Glow-duration control unit

ELECTRICAL TERMINAL DIAGRAM - PREHEATING SYSTEM



- 1 = Fuel filter
- 2 = Air-filter housing
- 3 = Injection nozzles

INSTALLATION POSITION OF COMPONENTS



- 1 = Temperature controlled  
cold start injection advance (KSB)
- 2 = Intake manifold

INSTALLATION POSITION OF COMPONENTS



Trouble-shooting instructions : PEU-5006  
BOSCH system : LU2-Jetronic  
Make of vehicle : PEUGEOT  
Basic microcard : OPE-512

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following vehicle model:

PEUGEOT 505 2.2 Injection 03.86->  
with 2.165 l / 4-cyl. ZDJL engine

- \* LU2-Jetronic with 25-pin control unit:  
0 280 000 344.
- \* Engine-speed triggering from term. 1 of ignition coil.
- \* 5-pin air-flow sensor and 7-pin control relay.
- \* Solenoid-operated injection valves with brass-wire coil.
- \* Start control
- \* Delayed overrun cut-off by LU control unit.
- \* Voltage supply of auxiliary-air device from term. 15.
- \* Lambda closed-loop control heated sensor.
- \* 3-way exhaust-gas catalytic converter.
- \* Sometimes with in-tank pre-supply pump.
- \* For testing the fuel pressure, connect in pressure tester with connecting part KDJE-P 100/14 at fuel-distribution-pipe inlet.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!  
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

\* Prevent fuel from being injected during the compression test.  
For this reason, disconnect control relay.

For further precautionary measures, see basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
*	*	*	*	*	*	*	*	*	*	Universal test adapter
*										Electric fuel pump
*	*	*	*							Auxiliary-air device/idle actuator
*	*	*	*	*	*	*	*	*	*	Air-flow sensor/air-mass sensor
*	*	*	*		*					Intake system
		*	*	*		*	*			Solenoid-operated injection valves
*	*	*			*	*				Fuel pressure
				*	*					Fuel quantity
		*	*	*	*	*				Throttle valve
				*						Overrun cut-off
*		*								Start control
				*						Ground
*	*	*	*	*	*					Alternator, interference suppress.
		*	*	*		*				CO exhaust-gas adjustment
				*						Control unit
						*				Catalytic converter
		*	*	*	*					Lambda closed-loop control

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01  
 Adapter lead: 1 684 463 123

Test step	Switch V	$\Omega$	Termi- nals	Testing of component/function	Test instructions/ Test conditions	Set values
1	5	—	1 — 5	Voltage pulses from ignition coil term. 1	Shift into neutral, start engine	Ignition pulses on oscilloscope
2	6	—	9 — 5 (+) (—)	Voltage from control relay term. 87	Shift into neutral, start engine	8...15 V
3	7	—	4 — 5 (+) (—)	Voltage from ignition and starting switch term. 50	Shift into neutral, start engine	8...15 V
4	 V	11	8 — 5	Resistor set in air-flow sensor	—	100...200 $\Omega$
5	 V	12	7 — 5	Resistance of potentio- meter in air-flow sensor	Deflect air-flow sensor flap as far as it will go.	60...1000 $\Omega$
6	 V	13	10 — 5	Resistance, temperature sensor (engine)	+15...+30°C: Approx. +80°C:	1,45...3,3 k $\Omega$ 280...360 $\Omega$
7	 V	14	13 — 5	Frame connection of output stage		0...10 $\Omega$

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01  
 Adapter lead: 1 684 463 123

Test step	Switch V    Ω	Termi- nals	Testing of component/function	Test instructions/ Test conditions	Set values
8	$\begin{array}{c}   \\ \text{V} \end{array}$	16	2 - 9 Resistance of idle contact	Accelerator pedal in rest position : Slightly depress accelerator pedal :	0...10 Ω infinity Ω
9	$\begin{array}{c}   \\ \text{V} \end{array}$	17	3 - 9 Resistance of full-load contact	Accelerator pedal in rest position : Fully depress accelerator pedal :	infinity Ω 0...10 Ω
10	$\begin{array}{c}   \\ \text{V} \end{array}$	18	12 - 9 Resistance of shunt- connected solenoid-oper- ated injection valves	+15...+30°C : Approx. +80°C :	6,8...9,5 Ω 7,0...10,0 Ω

REMARK: The following components with respective connecting leads are not covered by the universal test adapter for these tests:

1. Auxiliary-air device: positive lead from term. 87 of control relay, negative lead to engine ground.
2. Electric fuel pump: positive lead from term. 87b of control relay (via pump fuse), negative lead to vehicle ground.
3. Sensor heater: positive lead from term. 87b of control relay (via sensor fuse), negative lead to engine ground.
4. Lambda sensor: sensor lead to control unit term. 20 (shielding to term. 5), sensor housing to vehicle ground.

## TEST SPECIFICATIONS

Component/Function	Set values
Electric fuel pump	
* Fuel delivery at return:	at least 700 cm <sup>3</sup> /30 s
* Supply voltage under load:	at least 12 V

## Pressure regulator

* Fuel pressure	
with engine at standstill:	2,3...2,7 bar
at idle:	approx. 0.5 bar lower

## Fuel system, leakages

* Fuel pressure after 20 mins with engine at standstill:	at least 1.0 bar
--	------------------

## Auxiliary-air device

* 0 280 140 122 resistance value	30...65 $\Omega$
* 0 280 140 185 resistance value	45...80 $\Omega$

## Air-flow sensor

* Resistance value between	
term. 8 and term. 5:	340 ... 450 $\Omega$
term. 7 and term. 5:	60 ... 1000 $\Omega$ 1)
term. 9 and term. 5:	500 ... 760 $\Omega$
term. 8 and term. 9:	160 ... 300 $\Omega$
1) (Deflect air-flow sensor flap fully)	

## Temperature sensor (coolant)

* Internal electrical resistance at ambient temperature	
+15...+30°C:	1,45...3,3 k $\Omega$
With engine at normal operating temperature approx. +80°C:	280...360 $\Omega$

## Lambda-sensor heater

* Internal electrical resistance (PTC) with engine at standstill:	1...15 $\Omega$
---	-----------------

M09



## TEST SPECIFICATIONS (Continued)

Component/Function	Set values
--------------------	------------

## Solenoid-operated injection valve

* Internal electrical resistance at ambient temperature	
+15...+30°C:	14,5...17,5 $\Omega$
* Leakage after 60s:	no drop must fall

## Start control

* Voltage at injection valve on initiation of starting:	greater than 1.5 V
after approx. 15s:	approx. 0.5 V

## Idle adjustment

Engine at normal op. temp., approx. +80°C	
* Idle speed:	850...900 min <sup>-1</sup>

## CO adjustment

Integrator voltage	
Engine at norm. op. temp., (test pin term. 22) approx. +80°C	

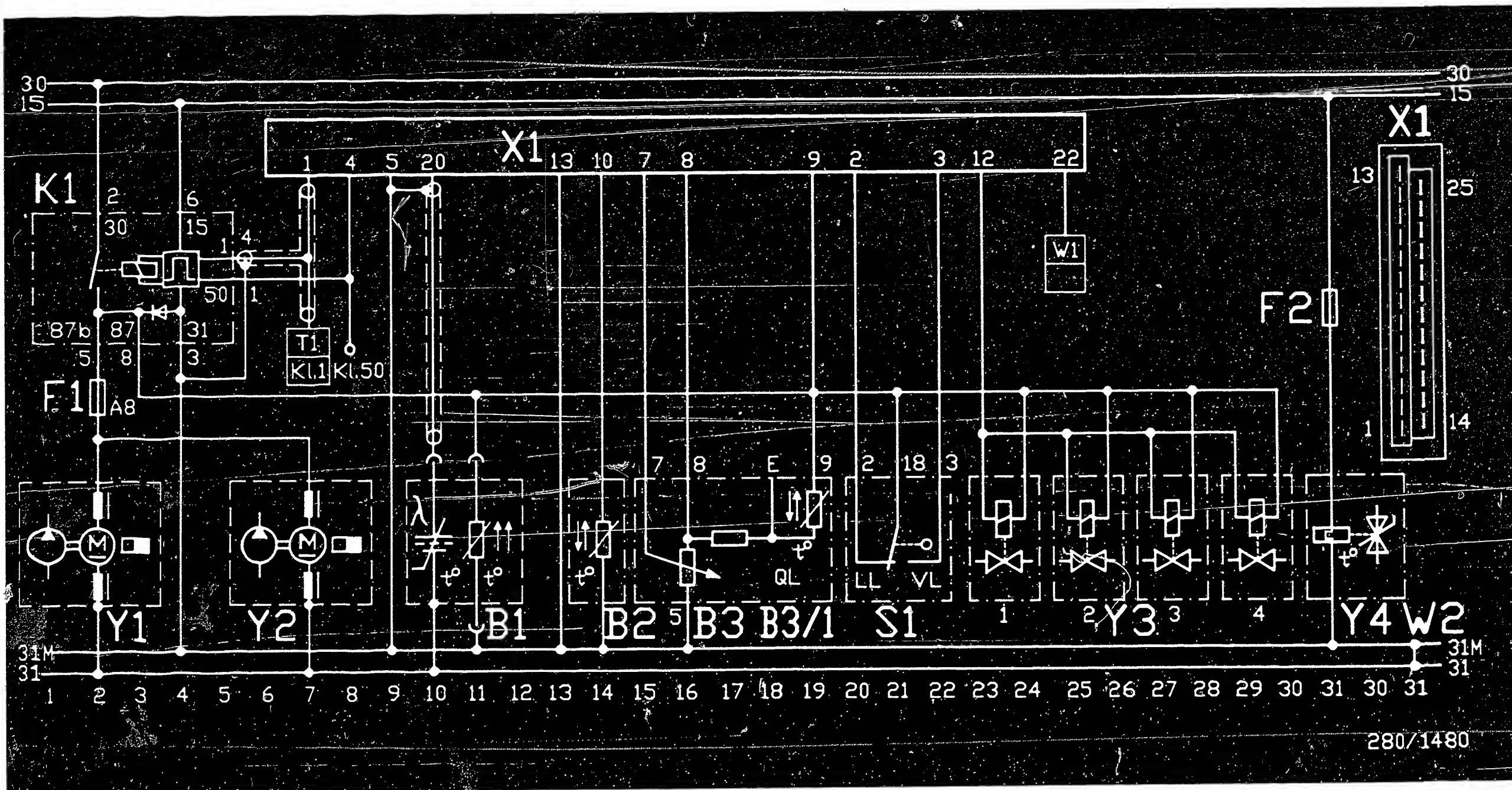
* Open-loop control (pull apart plug-in connection of sensor lead):	fixed voltage value between 5 ... 9 V
* Closed-loop control (connect up plug-in connection):	indicator fluctuates between 2 voltage values
* Adjustment:	mean value with closed-loop control same as with open-loop control

* Rich value (pull apart plug-in connection and apply control-unit lead to ground):	10...13 V
* Lean value (apply 2V to control-unit lead):	less than approx. 1.0 V

See equipment and Autodata microcards for the setting values for ignition, valve clearance and other engine-related data.

M10





280/1480

B1 = Lambda sensor (heated)  
 B2 = Temperature sensor (engine)  
 B3 = Air-flow sensor  
 B3/1 = Temperature sensor (air intake)  
 F1 = Fuse (electric fuel pump/s)  
 F2 = Fuse (auxiliary-air device)  
 K1 = Control relay

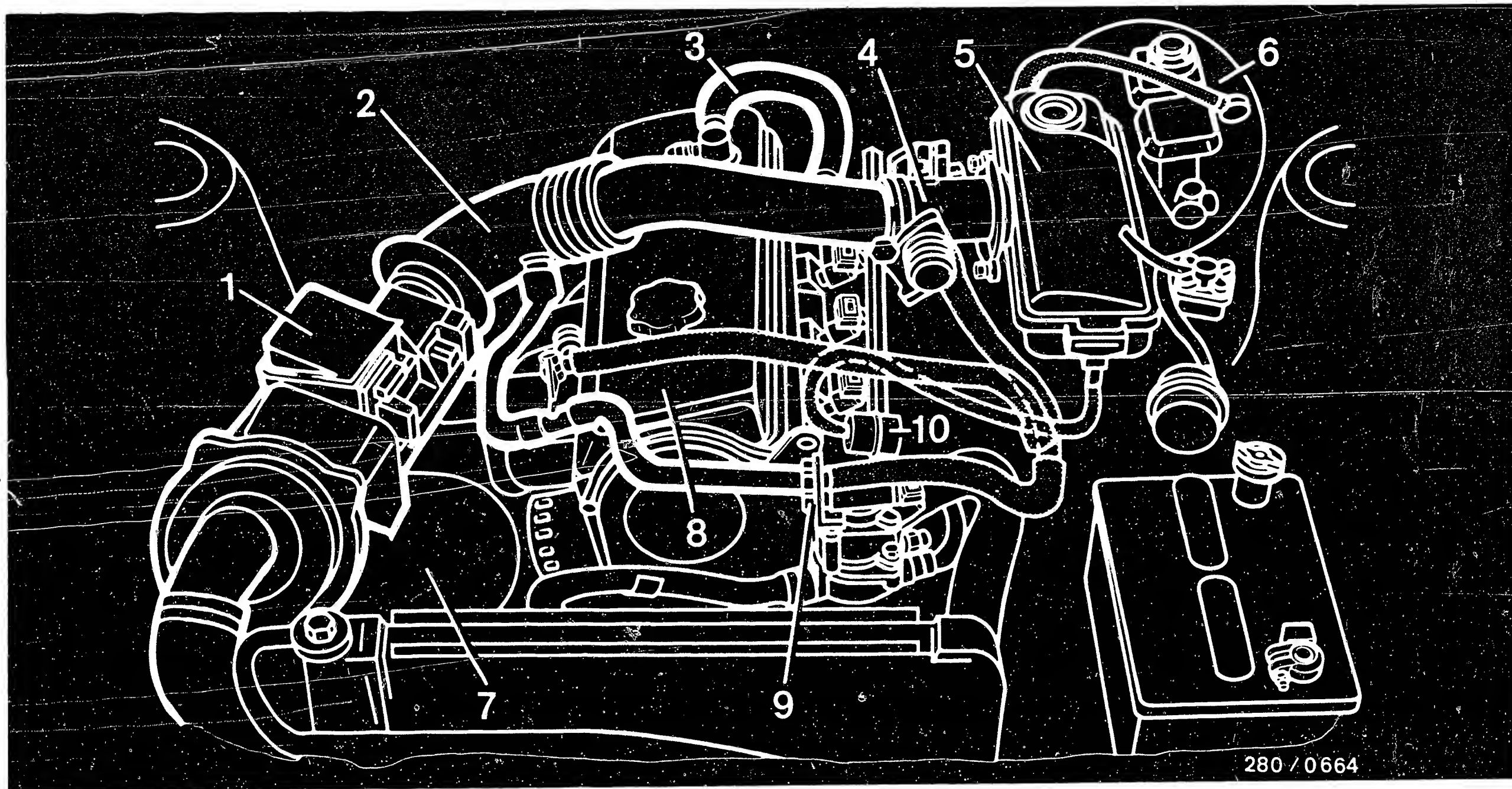
S1 = Throttle-valve switch  
 W1 = Test pin/integrator voltage  
 W2 = Ground strap (engine)  
 X1 = Control-unit plug  
 Y1 = Electric fuel pump  
 Y2 = Sometimes in-tank pre-supply pump  
 Y3 = Solenoid-operated injection valves  
 Y4 = Auxiliary-air device

ELECTRICAL TERMINAL DIAGRAM

M11 —————>

M12 —————<





280 / 0664

— = Atmospheric pressure  
 - - - = Intake-manifold pressure

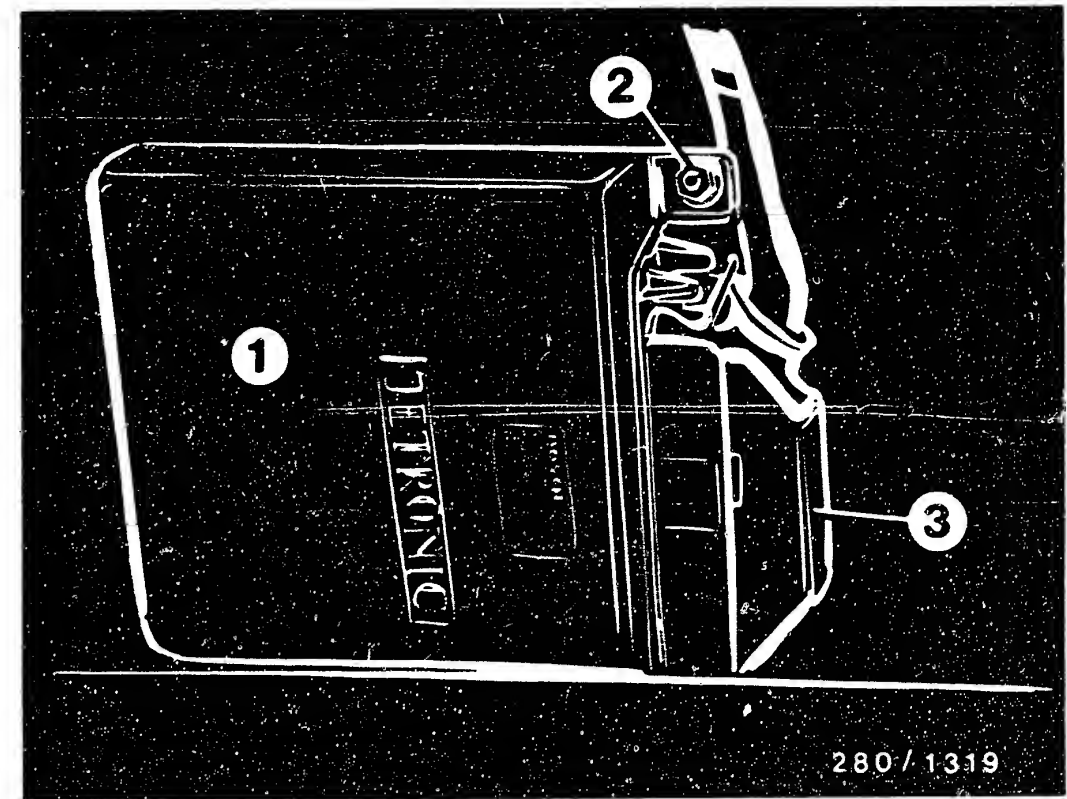
1 = Air-flow sensor  
 2 = Air-guide hose  
 3 = Crankcase bleeder  
 4 = Throttle-valve assembly  
 5 = Intake manifold

6 = Brake power-assist unit  
 7 = Air filter  
 8 = Valve cover  
 9 = Auxiliary-air device  
 10 = Pressure regulator

DIAGRAM OF AIR LINES



For production reasons:  
continued on the following  
coordinate.



- 1 = Control unit
- 2 = Fastening screws
- 3 = 25-pin control-unit plug

#### INSTALLATION POSITION OF COMPONENTS

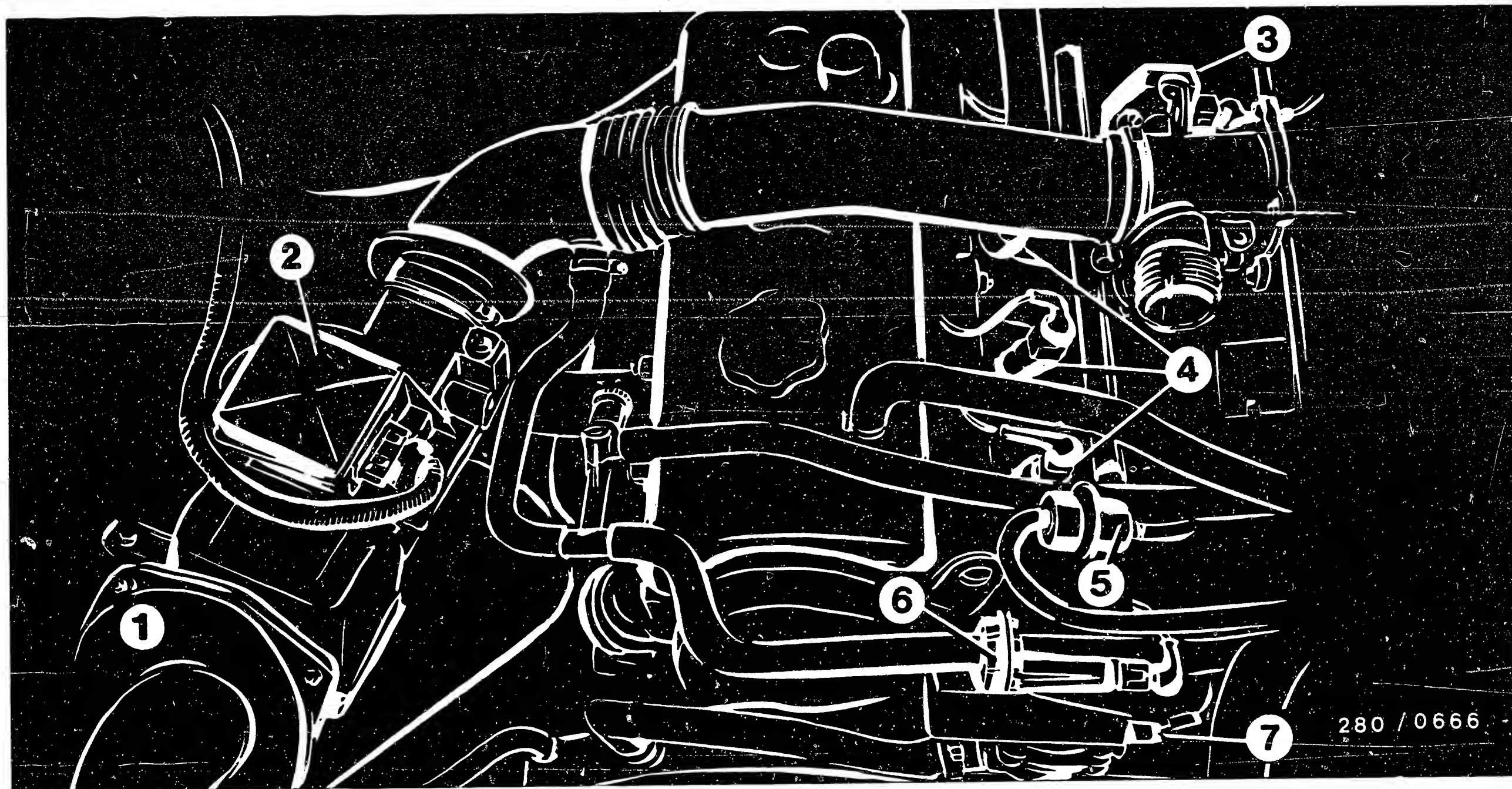
The indications "right" and "left" always refer to the forward direction of travel.

\* LU-Jetronic control unit in the passenger compartment.

Access is gained to the control unit behind the glove compartment by pivoting the unlatched glove compartment. For testing electrically with the universal test adapter, push open the latch (locking tongue) and disconnect the control-unit plug. Connect 25-pin adapter lead to the periphery.

\* Control relay on the left of the steering column, beneath the cover.

\* Pump fuse on the right of the steering column.

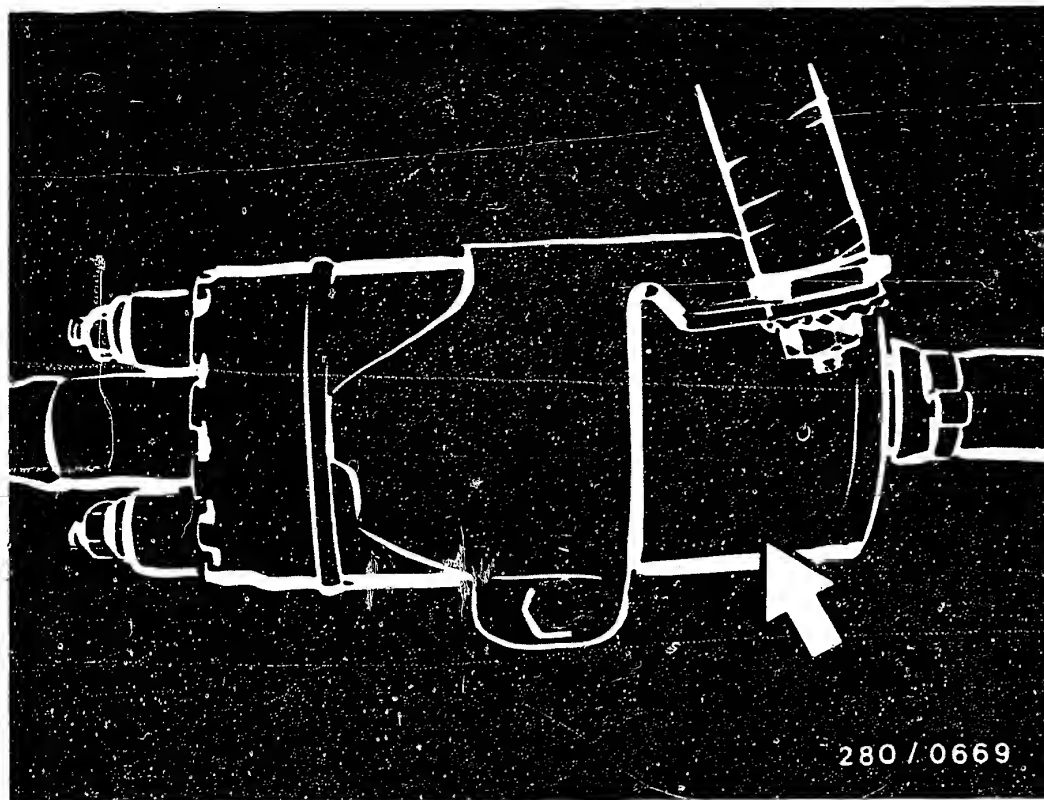


280 / 0666

- 1 = Air filter
- 2 = Air-flow sensor
- 3 = Throttle-valve switch
- 4 = Solenoid-operated injection valves

- 5 = Pressure regulator
- 6 = Auxiliary air device
- 7 = Temperature sensor (engine)  
(concealed)

\* Layout of the components on the engine

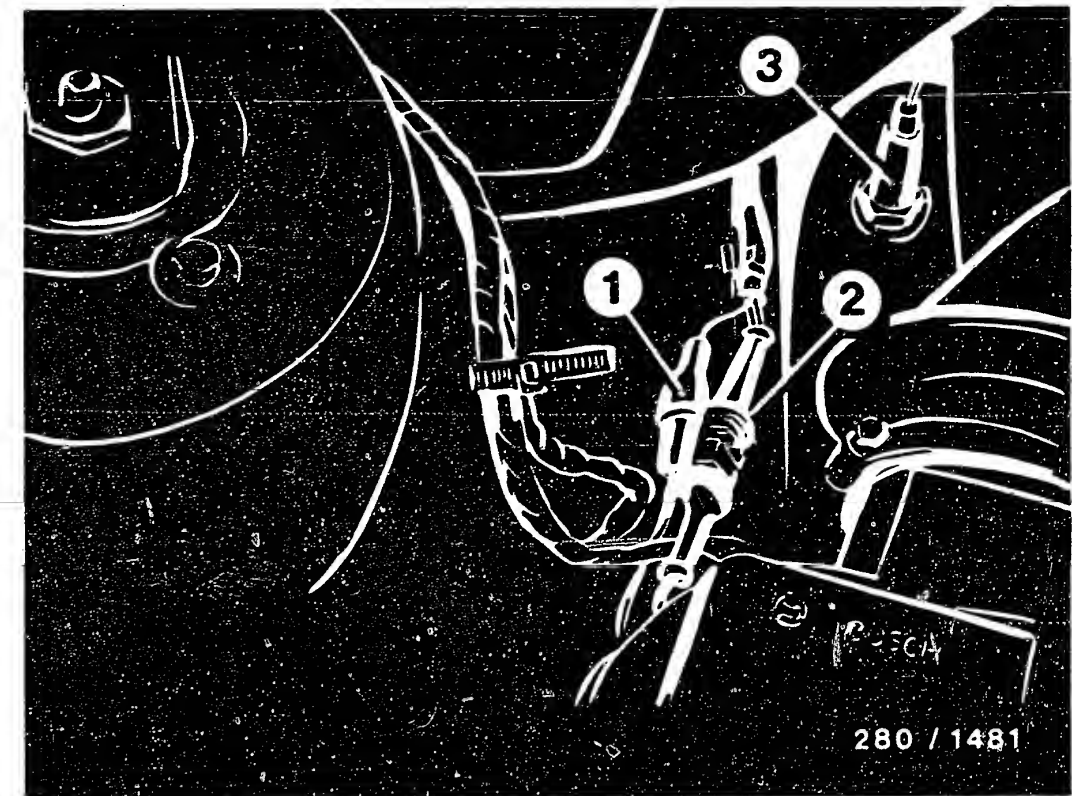


\* Components of the fuel-supply system

The electric fuel pump (arrow) is mounted on a bracket on the underside of the vehicle behind the differential.

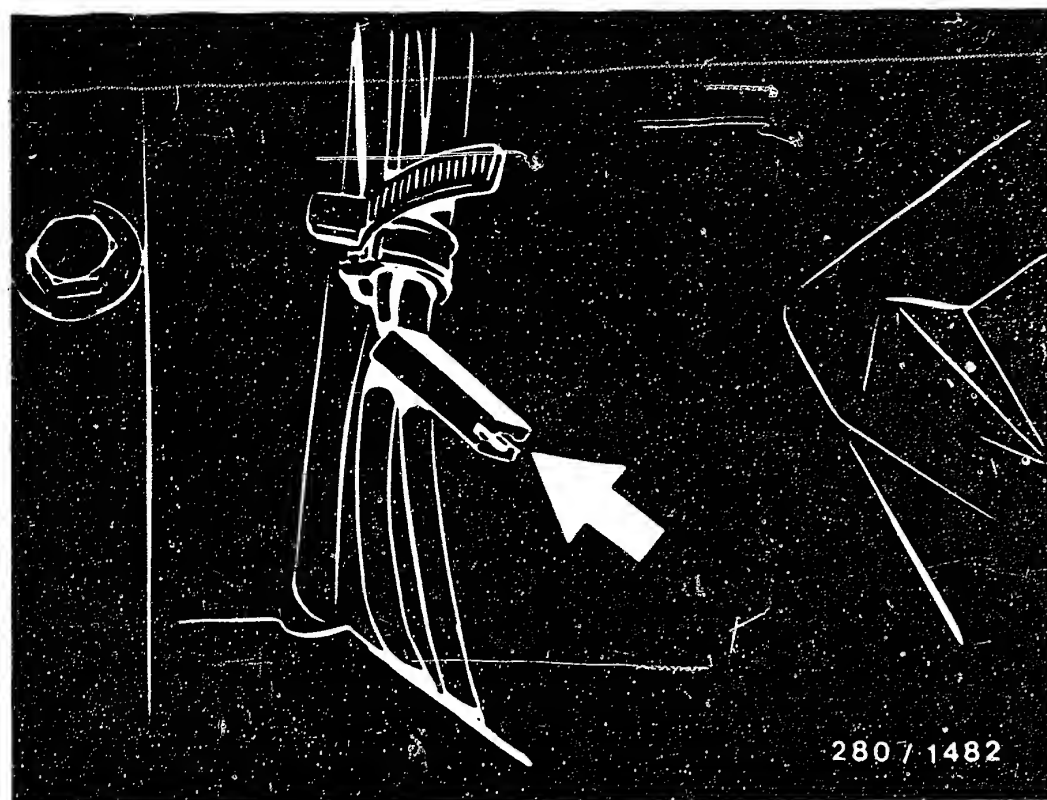
\* The fuel filter is located on the left in front of the rear axle.

\* Sometimes an in-tank pre-supply pump is installed.



\* Components of the lambda closed-loop control

- 1 = Plug-in connection, sensor signal
- 2 = Plug-in connection, sensor heater
- 3 = Lambda sensor (sometimes concealed)



Arrow = Test pin for integrator voltage (lambda closed-loop control) in the eng. compartment on the right

For production reasons:  
continued on the following  
coordinate.